WELLS' AUTO-ELECTRICIANS' HANDBOOK

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WELLS' AUTO-ELECTRICIANS' HANDBOOK

A REFERENCE BOOK OF ADJUSTMENTS, TESTS, REPAIRS AND PERFORMANCE OF ELECTRIC LIGHTING AND STARTING EQUIPMENT ON AUTOMOBILES

Arranged for Service Stations and Repair Shops

By HARRY LORIN WELLS

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By

HARRY LORIN WELLS

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TO THE SERVICE STATION

Wells' Auto-Electricians' Handbook is designed to furnish you with all of the information on performance and adjustment of electric starting and lighting equipment that is required in service station work.

It is assumed that you are engaged in electrical repairing in the practical everyday part of this work, and that you are familiar with the elementary principles of generators, motors and controlling devices. All instruction of that nature is therefore omitted.

Shop and roadside adjustments for each make and type of equipment in general use are given in plain language that is non-technical as far as the nature of the subject will permit. The directions are given in exact and unmistakable terms, and if followed out carefully the desired results will be obtained.

The arrangement is systematic and uniform for each class of machines treated. It is an arrangement easy to follow and has proven to be the one best adapted for working conditions in the shop.

The Handbook is an adaptation of the best features found in the service station publications of the leading manufacturers, making only such changes and modifications as fit the data to its application on all makes rather than to any one make in particular. Wells' Auto-Electricians' Handbook takes the place of all the miscellaneous information that has heretofore been obtainable only from a great variety of sources; placing all of this information in compact form and arranged for quick reference.

Suggestions for the improvement of the service are always appreciated from those using the Handbook. Additions being made as occasion requires will keep the service station using Wells' Auto-Electricians' Handbook in the front rank at all times.

HARRY LORIN WELLS

HOW TO USE
Wells' Auto-Electricians' Handbook

WORKING ON CAR

Turn to the "Car Index" in which are listed practically all cars with their years and models. Opposite the car's name, its year and its model, will be found the types and makes of equipment used. In the extreme right hand column will be found the section numbers in Wells' Auto-Electricians' Handbook, to which you should turn for all information.

If only the electric units are available, and it is not known from what car they were taken, look at the name plate, or, if there is no name plate, look on the field frame or end plates of the generator for the type or model number. If work is to be done on the starting motor, secure the type or model number of the motor also.

Now look in the "Model Index" under the name of the equipment, and opposite the number or letters of the type or model of the unit to be worked upon will be found the number of the section in the Handbook that covers this equipment.

Turn to that section for all test data. At the end of the section and following the word "Diagrams" will be found the numbers of the wiring diagrams that apply to the equipment being worked upon. Turn to these diagrams in the portion of the Handbook devoted to internal wiring diagrams.

WORKING ON UNITS OUT OF THE CAR

It is unnecessary to know what car the unit was used in. Simply examine the name plate, field frame or end plate to find the type or model number of the unit.

Then turn to the "Model Index" under the name of the equipment and opposite the number or letters of the type or model find the section of the Handbook covering this equipment.

At the end of the section of test data, following the word "Diagrams" will be given the numbers of the internal wiring diagrams that are to be used.

Section Numbers and Wiring Diagrams

Each make of equipment has been assigned a certain series of numbers in Wells' Auto-Electricians' Handbook. All of the more generally used makes start with a new hundred; thus, everything starting with "3" in the hundreds column refers to Auto-Lite equipment, including sections 301, 302, 303, etc. Similarly, all Auto-Lite wiring diagrams are numbered in the three hundred division. The diagram numbers are always higher than the test data section numbers; thus, Auto-Lite diagrams start with number 351. Makes of equipment that have been discontinued and those used in smaller numbers do not always start with the even hundred. Reference to the Index will make the arrangement clear.

As new sheets are sent out for the purpose of keeping the Handbook up to date, they will be numbered to fit in with those already furnished. These new sheets should be inserted in the Handbook at the points indicated by their numbers. For example: when a sheet numbered "1202" is received, it should be placed to follow "1201." New diagrams should be similarly handled, placing them in accordance with their numbers. This system of numbering allows for an indefinite expansion of the Handbook without changing the alphabetical order of the arrangement.

It will be noted that all of the test data is in one part of the Handbook and all of the wiring diagrams in another part. Should the user desire to do so, all sheets and diagrams may be placed in one numerical order, when it will be found that all of the diagrams for any one make follow immediately after the test data sheets for that make.

The test data sheets start with number 101 and the wiring diagrams with number 111. Numbers up to 100 are reserved for information of a general nature dealing with matters of service.

Explanation of Test Data Sheets

The information on the test data sheets is always arranged in the same order, no matter what the make of equipment. This uniform arrangement soon becomes familiar to the user, so that he knows exactly where to look for the information that he desires on any given piece of work.

The arrangement is as follows:

Maker's name or trade name on top line.

Description of general construction of equipment treated in that section.

TYPE, MODEL, ETC.: The manufacturer's number or letter designation of the machines included in this classification. The words at the left of this list vary in accordance with the varying practice of equipment makers, some using the word "Model," others using "Type," "Number," "Frame," or other words of similar meaning.

VOLTAGE: This gives the nominal working voltages for charging, starting and lighting. When but one voltage is given it refers to all three functions. If different voltages are used, they are specified in each case.

CHARGE RATES: In this part of the test data are given the correct performance of the units together with information necessary in special cases for making correct settings or adjustments. Observe the following:

Do not rely on the car's ammeter, but connect a reliable testing instrument in the charging line as directed under ***"Generator, Test Terminals"*** in next column.

Unless specified otherwise, the tests are to be made with a hot generator (after a run at nearly full load) and a fully charged battery in circuit.

The charge rates given ignore the ignition current, which may run from 0.5 to 3.5 amperes. This is one of the reasons for not depending on the car's ammeter, as it measures the net charge to the battery and not the generator output in almost all cases.

The values given are limits; that is, the performance as to amperage, voltage and speed should come within the limits given. When but a single value is given, the performance should come within ten per cent of this value to be considered satisfactory.

Observe carefully any special instructions and precautions given for testing the charge rate. Do not assume that results will be the same even with slightly different conditions, for had this been the case the special instructions would not have been given.

GENERATOR: First mentions the number of poles, the number of field coils, the windings contained in each coil, and the types of windings used. The number of brushes, their position, and their use is given next.

In special constructions, the next item describes the armature and commutator construction.

Test Terminals: Tells where to connect an ammeter and a voltmeter for testing the generator performance. The ammeter is always placed in series with the charging circuit and without regard to polarity, therefore a zero center instrument will prove most convenient. The voltmeter is always placed (in effect) across the generator brushes so that the generator voltage is measured. Do not open any connections in attaching the voltmeter; simply attach it between the points specified. Be sure that ground connections are made to clean metal parts of the generator. If battery voltage is to be measured, connect the voltmeter across the battery terminals, not at the generator. (See Diagram 54.)

Explanation of Test Data Sheets—*Continued.*

Motoring Current: This information is given when it is of value in determining the condition of the generator. Readings with the generator motoring will very often fail to indicate existing trouble, especially armature faults.

Field Terminals: Gives the points through which the various field windings may be tested. When testing through a field circuit for shorts, opens, grounds, etc., remove all other connections from the points mentioned, especially the outside wires, and in all cases raise the brushes from the commutator and place pieces of paper between brush and commutator. This will isolate the field windings so that they can be tested. (See Diagram 54.)

Field Current: This value is tested with an ammeter in series with the field circuit.

REGULATION: Mentions the principle upon which the output of the generator is limited or regulated and gives the necessary instructions for raising or lowering the charge rate. These adjustments are to be made in strict accordance with the information given under the foregoing division on ***"Charge Rates."***

CUT-OUT: Mentions the type of cut-out and its location. Gives the correct voltage and speed for closing and the discharge amperage for opening. Gives necessary instructions for adjusting spring tension, armature gaps, contact gaps, etc., to secure the correct opening and closing.

STARTER: Outlines the construction of the starting motor as to windings, poles, coils, brushes, etc. The wiring diagrams should be referred to in connection with this description. When the information is available the starting motor performance is given for torque, amperage, voltage and speed.

Special constructions of switches, shifting methods, etc., are treated under this heading.

DIAGRAMS: The diagrams that show the internal connections of the generators, motors and motor-generators in this classification are given under this heading for ready reference.

WIRING DIAGRAMS

In almost all cases the internal wiring diagrams have been made directly from the machines or instruments themselves and they show the correct relative position of the parts; commutator, brushes, fields, terminals, etc.

Ground connections are sometimes shown directly on wire ends and brushes, but it will be understood that they are generally made to the field core frame, brush holder stud or brush ring.

Some diagrams are marked as to which end of the machine is toward you. In all other cases the diagram is drawn looking at the commutator end and with the end cap and brushes in their running positions. That is, the user should consider that the end cap is either removed or is transparent, but that the brushes and rings remain in place. A brush shown on the right hand side (for example) is on the right hand side when in its running position. This same brush, however, might be on the left hand side of the end cap when the cap is removed and when the brushes are mounted in the cap. Oftentimes the user will remove the drive end plate and armature, then look through the armature tunnel toward the brushes. Diagrams are not drawn from this viewpoint and with a machine disassembled in this manner. It should be remembered that all connections are looked at from the commutator end and in their running positions.

In some cases circuit diagrams, or "schematic" diagrams, are given. These, as will be apparent from examination, do not show the relative positions of the parts as built into the machines, but show only the electrical connections in such a way that the principle and action can more easily be followed out.

When armature rotation is marked as being in a certain direction, it should be remembered that opposite rotation will change the field connections or the brush positions or both.

Heavy lines indicate series circuits, starting circuits, charging main lines, etc. Lighter lines indicate shunt circuits, field circuits, resistances, etc.

Dotted lines (unless marked otherwise) indicate housings covers, frames, etc.

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	1917	37, 41		4	West	450	318	West	Vert.	pos.	2911, 2941	
	1918	41		4	Auto-L	GA	ME	Conn	GA	neg.	302, 341	
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	1921	C		6	G & D	641	521	Conn	M	pos.	1308	
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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Anderson (Continued)	1918, 19	400, Ser. 18, 20		6	West	760	710	Conn	GA	pos.	2911, 2941	*An*
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	1920, 21	Ser. 30, 40		6	Remy	913-A,913B	705A	Remy	284B	pos.	2010, 2041	
Apperson	1912	45, 55		4	Ester	D-B	None	Nat'l	Mag	neg.	1102	
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	1915	40		4	Bijur	K638	A14, A35	Remy	284B	two	401, 441	
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	1916	8-58	First 500	8	West	400	700	Remy	284B	pos.	2906, 2941	
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	1918	8-18, 8-18A		8	Bijur	L61	ED160	Remy	285B	neg.	404, 441	
	1919	8-19		8	Bijur	L61	ED160	Remy	284G	neg.	404, 441	
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Arbenz	1916, 17	25		4	Spl'f	A-25	6-12v M-G	Dixie	Mag	neg.	2307	
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	1914	4-40, 4-41		4	Remy	SL-3	M-Gen	Simms	Mag	two	2006	
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	1915-17	4-36	Teetor Eng	4	Remy	OB, OD	118A	Remy	48A	neg.	2002, 2041	
	1915	6-40		6	Delco	58	M-Gen	Delco	2111	neg.	710	
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	1916, 17	6-40		6	Remy	168A	186A	Remy	174A	neg.	2007, 2041	*Au*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Auburn	1916	4-38		4	Remy	18B	118A	Remy	170A	neg.	2007, 2041	*Au*
(Continued)	1917	6-39		6	Remy	168E, 168F	292A	Remy	174A	neg.	2007, 2041	
	1918	6-39		6	Remy	245D, 245H	292A	Remy	174A	neg.	2007, 2041	
	1918	6-44		6	Delco	83	M-Gen	Delco	2142	neg.	715	
	1919	6-39		6	Remy	230C	303A	Remy	284C	neg.	2010, 2041	
	1920	6-39		6	Remy	234E	705A	Remy	284B	pos.	2010, 2041	
	1921	6-39, 6-51		6	Remy	913A, 913B	705A	Remy	284C	pos.	2010, 2041	
Austin	1913, 14	55		6	West	221	390	West	Sep'e	pos.	2902, 2941	
	1914, 16	66, 77		6	West	240	390	West	Hor'l	pos.	2902, 2941	
	1917, 18			12	Delco	87	86	Delco	2123	neg.	724	
Beggs	1918, 19	18T, 19T		6	Auto-L	GH	ME	Conn	GA	neg.	304	
	1920-22	20T, 21T, 22T		6	Auto-L	GJ	MH	Conn	M	pos.	305	
Bell	1915, 16	A		4	Disco	26	M-Gen	A Kent	H	pos.	953	
	1917	17		4	G & D	400	146	A Kent	H	pos.	1307	
Belmont	1919	S	G. B & S Eng	4	Dyneto	CA	DA			neg.	1010	
Bergdoll	1913	30, 40		4	U.S.L	6-12v	M-Gen	Bosch	Mag	two	2501	
Biddle	1915	C		4	West	230	310	West	Hor'l	pos.	2902, 2941	
	1916	D		4	West	208, 230	318	West	Hor'l	pos.	2902, 2941	
	1916, 17	D		4	West	400	318	West	Vert	pos.	2906, 2941	
	1917	D		4	G & D	400	145	Eise'n	Mag	pos.	1307	
	1918, 19	H, K		4	Bijur	L61		Eise'n	Mag	pos.	404, 441	
	1919, 20	H, HA		4	G & D	801	513	Eise'n	Mag	pos.	1308	
Birch	1919	28 to 40	Lycoming Eng	4	Dyneto	CA	DA			neg	1010	
Bour-Davis	1916	17		6	Remy	243E	303A	Remy	284C	neg	2007, 2041	
	1917	17B		6	Remy	243D	293A	Remy	281A	neg.	2007, 2041	
	1918	18A		6	Remy	245D, 245E	180A	Remy	281A	neg.	2007, 2041	
	1919	18B		6	Remy	230C	303A	Remy	284C	neg.	2010, 2041	
	1920, 21	20, 21S		6	West	760		West		pos.	2911, 2941	
Brewster	1913, 14			4	West	250	503	Bosch	Mag	pos.	2902, 2941	
	1915, 16	91		4	U.S.L	E-196	M-Gen	Bosch	Mag	neg	2504	
	1917, 18	91		4	U.S.L	E-198	M-Gen	Bosch	Mag	neg	2504	*Br*

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections
Brewster	1919	91		4	U.S.L.	E-207	M-Gen	Bosch	Mag.	neg.	2504
(Continued)	1920	91		4	U.S.L.	E-207	M-Gen	Berl'g	Mag.	neg.	2504
Briscoe	1915	B		4	Spl'f	A-25	12-12v M-G	A Kent	H	neg	2307
	1916	4-38		4	Spl'f	A-25	6-12v M-G	Conn	GO	neg.	2307
	1916	4-38		4	Spl'f	A-25	6-12v M-G	Remy	171A	neg.	2307
	1916, 17	8-38, 8B		8	Spl'f	A-25	6-12v M-G	Remy	285B	neg.	2307
	1917	4-24, B-24		4	Spl'f	RGU-5	SUB-7	Conn	GO	pos.	2305
	1918, 19	4-24, B-24		4	Auto-L	GH	ME	Conn	GA	neg.	304, 341
	1919, 20	4-24		4	G & D	609	511	Conn	M	pos.	1308
	1920, 21	4-34		4	Auto-L	GJ	MJ	Conn	M	pos.	305, 341
Brown	1916, 17			4	A-Chal	MG	M-Gen			neg.	126
Buick	1914	B24, B25		4	Delco	26, 40	M-Gen	Delco	2107	neg	706
	1914	B36, B37		4	Delco	33, 42	M-Gen	Delco	2107	neg.	706
	1914	B54, B55		6	Delco	28, 28B	M-Gen	Delco	2097	neg.	702
	1915	C24, C25		4	Delco	53	M-Gen	Delco	2111	neg.	707
	1915	C36, C37		4	Delco	51	M-Gen	Delco	2111	neg.	710
	1915	C54, C55		6	Delco	52	M-Gen	Delco	2111	neg.	710
	1916, 17	D44, D45, D46, D47		6	Delco	70	M-Gen	Delco	2123,30,38	neg.	717
	1916	D54, D55		6	Delco	69	M-Gen	Delco	2123,21,30	neg.	715
	1917	D34, D35		6	Delco	94, 115	M-Gen	Delco	2138	neg.	717
	1918	E34, E35		4	Delco	121	M-Gen	Delco	2157	neg	717
	1918	E44 to E50		6	Delco	117	M-Gen	Delco	2157	neg.	717
	1919	H44 to H50		6	Delco	117	M-Gen	Delco	2157	neg.	717
	1920	K44 to K50		6	Delco	117	M-Gen	Delco	2157	neg.	717
	1921	Ser. 21, 44 to 50		6	Delco	184	M-Gen	Delco	2159	neg.	717
	1922	Ser. 22, 34 to 37		4	Delco			Delco	2159		
Bush	1918, 19	EC-4	Lycoming Eng	4	Dyneto	CA	DA	Conn	GA	neg.	1010
Cadillac	1912			4	Delco	1	M-Gen	Delco	2022, 45	two	701
	1913			4	Delco	4	M-Gen	Delco	2092, 93	two	703
	1914			4	Delco	24	M-Gen	Delco	2104	pos.	704
	1915	51		8	Delco	44	M-Gen	Delco	2115	pos.	710
	1916	53		8	Delco	78	M-Gen	Delco	2115	pos.	719
	1917	55		8	Delco	98	M-Gen	Delco	2115	pos.	719
	1918, 19	57		8	Delco	98	M-Gen	Delco	2115	pos.	719
	1920, 21	59		8	Delco	162	M-Gen	Delco	2115	pos.	731
	1922	61		8	Delco			Delco	2115	pos.	

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Cameron	1914	30		4	Ward L.	F		Bosch	Mag.	two	2801	*Ca*
	1916			6	Spl'f	RGU		A Kent	H	pos.	2305	
	1917			6	G & D	400		Conn	GA	pos.	1307	
Campbell	1918, 19	C		4	Auto-L	GH	ME	A Kent	CC	neg.	304, 341	
Cartercar	1913	5		4	Jesco	3-13	M-Gen	Briggs	Mag.	two	1351	
	1914	7		4	Delco	32	M-Gen	Delco	2102	neg.	706	
	1915	9		4	Delco	53	M-Gen	Delco	2111	neg.	707	
Case	1913	40		4	West	200	330	Bosch	Mag.	pos.	2902, 2941	
	1914	25		4	West	250	503	Bosch	Mag.	pos.	2902, 2941	
	1914	35		4	West	202	320	Bosch	Mag.	pos.	2902, 2941	
	1915	25, 35, 40		4	West	208	325	West	Hor'l.	pos.	2902, 2941	
	1916	T-16, 7		4	West	450	700	West	Vert.	pos.	2906, 2941	
	1917	40		4	West	760	700	West	Vert.	pos.	2911, 2941	
	1917	T-17		4	Auto-L	GH	MD	Conn	GA	neg.	304, 341	
	1918, 19	U-18, U-19		6	West	760	711	West	Vert.	pos.	2911, 2941	
	1920, 21	V		6	West	760	751	Delco	2159	pos.	2911, 2941	
Chadwick	1913, 14	19		6	West	250	501	Bosch	Mag.	pos.	2902, 2941	
	1915, 16	19, 21		6	West	242	501	West	Hor'l.	pos.	2902, 2941	
Chalmers	1913	18		6	G & D	G-1	Air	Spl'f	Mag.	two	1301	
	1913, 14	17, 19		4	G & D	G-1	Air	Spl'f	Mag.	two	1301	
	1914	26		6	Dyneto	Entz	M-Gen	Bosch	Mag.	two	1001	
	1915	26A, 26B, 26C	Light Six	6	Dyneto	Entz	M-Gen	A Kent	K-2	two	1001	
	1915, 16	29	Master Six	6	Dyneto	Entz	M-Gen	Bosch	Mag.	two	1001	
	1916	32	Six-Forty	6	G & D	T-219	Y	A Kent	K-2	pos.	1303	
	1916	32B		6	Ward L.	RID	R & M	A Kent	K-2	pos.	2801	
	1916, 17	32B	After 3000 cars	6	West	209R	700	A Kent	K-2	pos.	2905, 2941	
	1916	35A	Six-Thirty	6	West	208R	700	Remy	171	pos.	2905, 2941	
	1916, 17	35A, 35B	Six-Thirty	6	G & D	400	128, 440, 482	Remy	284B	pos.	1307	
	1918	35C, 35D	After 1000 cars	6	West	760	710, 711	Remy	284B	pos.	2911, 2941	
	1919	35	Six-Thirty	6	Auto-L	GD	ME	Remy	284B	pos.	303, 341	
	1920, 21	35	Six-Thirty	6	Auto-L	GJ	MH	Remy	284B	pos.	305, 341	
Champion	1918, 19	C, CS		4	Dyneto	CA	DA	A Kent	CC	neg.	1010	
	1920, 21	K, KO		4	Dyneto	CA	DA	Conn	M	neg.	1010	*Ch*

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Chandler	1913, 14	14		6	West	202	501	Bosch	Mag.	pos.	2902, 2941	*Ch*
	1915	15		6	G & D	S	Y-1	Bosch	Mag.	pos.	1303	
	1916	16	To No. 35,000	6	G & D	233	126	Bosch	Mag.	pos.	1305	
	1917, 18	17, 18	35,001–60,000	6	G & D	400	150	Bosch	Mag.	pos.	1307	
	1919	25		6	West	760	710, 711	Bosch	Mag.	pos.	2911, 2941	
	1919, 20			6	G & D	607	504	Bosch	Mag.	pos.	1308	
	1920, 21			6	G & D	639	504	Bosch	Mag.	pos.	1308	
	1922			6	Bosch			Bosch	Mag.	pos.	505	
Chevrolet	1914	L		6	Auto-L	G	M	Simms	Mag.	two	302, 341	
	1915, 16	H2, H2½, H3, H4	Royal Mail, Amesbury and Baby Grand	4	Auto-L	GF	MC	Conn	E, G, GO	neg.	302, 341	
	1916, 17	490	1–50,000	4	Auto-L	GG	MF	Conn	GO	neg.	303, 341	
	1917	490	50,001–54,924	4	Auto-L	GG	MF	Conn	GA	neg.	303, 341	
	1917-20	490	54,925–300,000	4	Auto-L	GH	MF	Remy	287B	neg.	304, 341	
	1920-22	490	300,000 and up	4	Auto-L	GH	MF	Remy	287C	neg.	304, 341	
	1917, 18	D		8	Auto-L	GH	ME	Remy	287A	neg.	304, 341	
	1917	F, F2, F5		4	Auto-L	GH	ME	Conn	GO	neg.	304, 341	
	1918–21	FA, FB		4	Auto-L	GH	ME	Remy	287A	neg.	304, 341	
	1920	FB		4	Remy	248B	700B,710A	Remy	287A	neg.	2010, 2041	
Cino	1913	60		6	Electro	Ign-Gen	M-Gen	Electro		two	1075	
Cleveland	1919, 20	40		6	G & D	604, 642	500	G & D	21013	pos.	1308	
	1921	40		6	G & D	644	529	G & D	21013	pos.	1308	
	1921, 22	40		6	Bosch	1000	900	Bosch		pos.	505	
Climber	1919			4	Dyneto	CA	DA	A Kent	CC	neg.	1010	
	1920, 21	K		4	West	760	100	A Kent	CC	pos.	2911, 2941	
	1921	S		6	West	760	100	Bosch	Mag.	pos.	2911, 2941	
Colby	1913, 14	C, 60		6	G & D	G-1	K	Eise'n	Mag.	two	1301	
Cole	1912	30, 40		4	Ward L	F	R & M			two	2801	
	1913	4-50		4	Delco	8	M-Gen	Delco	2045	two	701	
	1913	4-40		4	Delco	12	M-Gen	Delco	2045	two	701	
	1913	6-60		6	Delco	15	M-Gen	Delco	2094	two	701	
	1914	39, Ser. 9		4	Delco	27, 27B	M-Gen	Delco	2105	neg.	702	
	1914	40, Ser. 9		6	Delco	37, 37B	M-Gen	Delco	2105	neg.	702	
	1915, 16	4-40, Ser. 10		4	Delco	65	M-Gen	Delco	2111	neg.	713	
	1915, 16	650, 651		6	Delco	59	M-Gen	Delco	2111	neg.	710	*Co*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Cole	1915-17	666		6	Delco	77	M-Gen	Delco	2117	neg.	713	Co
(Continued)	1915, 16	850		8	Delco	62	63	Delco	2117	neg.	711	
	1916	860		8	Delco	91	72	Delco	2123	neg.	723	
	1917	860		8	Delco	113	72	Delco	2146	neg.	724	
	1918	860		8	Delco	131	72	Delco	2162	neg.	724	
	1918, 19	870		8	Delco	138	72	Delco	2162	neg.	724	
	1920, 21	880		8	Delco	153	72	Delco	2127	neg.	724	
	1922	890		8	Delco			Delco				
Columbia	1917, 18	A, B, C, D		6	Ward L	RM-175A	RM-172D	A Kent	CC	pos.	2801	
	1919	19C, 19D, 19E	101–7,000	6	Auto-L	GJ	MG	A Kent	CC	pos.	305, 341	
	1920, 21	20C, 20D, 20H, 20E	10,000 and up	6	Auto-L	GJ	MH	A Kent	CC	pos.	305, 341	
Columbus			See Firestone-Columbus.									
Comet	1917-19	C-50, C-51		6	Dyneto	CA	DA	Delco	2138	neg.	1010	
	1919	C-52		6	Wagner	EM276	EM291			pos.	2703, 2741	
	1920, 21	C-53		6	Wagner	EM346	EM348, 375			pos.	2703, 2741	
Commonwealth	1916, 17	20		4	A-Chal	MG	M-Gen	Dixie	Mag	neg.	126	
	1917	32		4	Disco	28	M-Gen	Dixie	Mag	neg.	953	
	1917-21	32, 34, 40, 44, 45		4	Dyneto	CA	DA	A Kent	CC	neg.	1010	
	1919	40		6	Dyneto	CA	DA	A Kent	CC	neg.	1010	
Conestoga	1917, 18			4	Dyneto	CA	DA	Conn	GA	neg.	1010	
	1919, 20			4	Bijur	P-210	FD-140	Conn	M	neg.	404	
Continental	1914	27		4	Jesco	3418	M-Gen	Remy	Mag	two	1352	
Corbitt	1913, 14	D		4	N East	A-2000	M-Gen	Conn	PD	two	1701	
	1915	E, F		4	Jesco	7-NU	M-Gen	A Kent	K2	pos.	1353	
Correja	1914	H		6	Ward L	F		Simms	Mag	two	2801	
Crane			See Simplex.									
Crawford	1913	13-30		4	G & D	G-1	H	Remy	Mag	two	1301	
	1913	13-40		4	G & D	G-1	K	Bosch	Mag	two	1301	
	1914	14-40		4	West	230	310	West	Hor'l	pos.	2902, 2941	
	1915	6-35	Cont'l 6N Eng	6	West	240	310	West	Hor'l	pos.	2902, 2941	Cr

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections
Crawford	1916-18	6-35, 6-40	Con'tl 7N Eng.	6	West	400	318	West	Vert.	pos.	2906, 2941
(Continued)	1919-21	6-40	Cont'l 9N Eng.	6	West	760	711	Bosch Mag.	AKentCC	pos.	2911, 2941
Crescent	1914			4	West	230	310	West	Hor'l.	pos.	2902, 2941
	1915			6	West	240	310	West	Hor'l.	pos.	2902, 2941
Croxton-Keeton	1913	A		4	Jesco	3-13	M-Gen	Eise'n.	Mag.	two	1351
	1914	B6		6	N East	B	M-Gen	Mea	Mag.	two	1702
	1915	4-35		4	Delco	41	M-Gen	Delco	2105.	neg.	706
Crow-Elkhart	1914, 15	D-45, E-45		4	Remy	17B		Remy	OA	neg.	2002, 2041
	1915	Junior		4	Spl'f	A-28	M-Gen	Dixie	Mag.	neg.	2307
	1916	23, 25, 30		4	Disco	28	M-Gen	Remy	49	neg.	953
	1916	30, 33		4	Dyneto	VA	UA	Conn	GO	neg.	1008
	1917-19	33, 35, H		4	Dyneto	CA	DA	Conn	GA	neg.	1010
	1918, 19	K-34, K-36		6	Dyneto	CA	DA	Conn	GA	neg.	1010
	1920, 21	L		4	Dyneto	CA	DA	Conn	M	neg.	1010
	1920, 21	H-55, S		6	Dyneto	CA	DA	Conn	M	neg.	1010
Cunningham	1914	M		4	N East	B-1102	M-Gen	Bosch	Mag.	two	1702
	1914, 15	R		4	G & D	G-1	K	Bosch	Mag	pos.	1301
	1915	R		4	West	251	502	Bosch	Mag	pos.	2902, 2941
	1916	S		4	West	256	502	Bosch	Mag	pos.	2902, 2941
	1917	V-1		8	West	781R		Delco	2162	pos.	2906, 2941
	1918, 19	V-2, V-3		8	West	782R		Delco	2162	pos.	2906, 2941
	1920, 21	V-4		8	Delco	182	183	Delco	2135	neg.	727
Daniels	1915, 16	A		8	West	400	750	West	Vert.	pos.	2906, 2941
	1917	A		8	West	400	751	West	Vert.	pos.	2906, 2941
	1918, 19	B		8	West	760	751	West	Vert.	pos.	2911, 2941
	1920, 21	D		8	Delco	169	170	Delco	2127	neg.	726
Davis	1914	35		4	West	260	300	West	Sep'e	pos.	2902, 2941
	1914	50		6	G & D	G-1	K-2	Mea	Mag.	pos.	1301
	1915	50		6	G & D	T	Y	Bosch	Mag.	pos.	1303
	1915	38A, 38B		4	West	400	318	West	Vert.	pos.	2906, 2941
	1916	38C		4	Delco	81	M-Gen	Delco	2140	neg.	715
	1916	E		6	Delco	73	M-Gen	Delco	2140	neg.	715
	1916	F, G		6	Delco	83	M-Gen	Delco	2141	neg.	715
	1917	H, I, K		6	Delco	105	106	Delco	2139	neg.	724

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections
Davis	1917	J		6	Delco	114	102	Delco	2139	neg.	724
(Continued)	1918, 19	H, I, L, N, P		6	Delco	135	136	Delco	2158, 59	neg.	724
	1918, 19	J, M		6	Delco	105	106	Delco	2158	neg.	724
	1920	51 to 55	Cont'l 7N Eng	6	Delco	165	164	Delco	2159	neg.	726
	1921, 22	51 to 55	Cont'l 7R Eng	6	Delco	165	181	Delco	2159	neg.	726
Detroiter	1914, 15	C		4	West	230	300	West	Hor'l	pos.	2902, 2941
	1915, 16	C		4	Remy	11A, 17A	9A, 113A	Remy	O	two	2002, 2041
	1916			8	Remy	16A	182A	Remy	173A	neg.	2007, 2041
	1916, 17	6-45		6	A-Lite	GG	ME	Conn	GO,GA	neg.	303, 341
Dixie	1915		1–2200	4	Dyneto	B	M-Gen	Conn	GOM	two	1004
	1916	36, 56	2201–3500	4	Dyneto	VA	UA	Conn	GOM	two	1008
	1917-19	L, H	3501–6000	4	Dyneto	CA	DA	Conn	GOM	two	1010
	1920, 21	H	7000	4	Dyneto	CA	DA	Eise'n	Mag	neg.	1010
Dodge	1915, 16		1–74021	4	N East	D-1264	M-Gen	Eise'n	Mag	neg.	1704
	1916		74022–90000	4	N East	D-1264	M-Gen	Delco	2128	neg.	1704
	1916, 17		90001–148965	4	N East	G-3554	M-Gen	Delco	2128	neg.	1706
	1917		148966–212873	4	N East	G-3554G1	M-Gen	Delco	2128	neg.	1706
	1917, 18		212874–234375	4	N East	G-3566S	M-Gen	Delco	2128	neg.	1706
	1918		234376–244164	4	N East	G-3566S	M-Gen	N East	10000	neg.	1706
	1918		244165–275254	4	N East	G-3566	M-Gen	N East	10000	neg.	1706
	1919–21		275255–	4	N East	G-3566	M-Gen	N East	10004	neg.	1706
Dorris	1913	H	After 5300	4	West	250	501	Bosch	Mag	pos.	2902, 2941
	1914	I		4	West	280	310	West	Hor'l	pos.	2902, 2941
	1914	I		4	West	251	501	Bosch		pos.	2902, 2941
	1915	IA4		4	West	208	315	Bosch	Mag	pos.	2902, 2941
	1915, 16	IA6	Up to 8054	6	West	203	310	Bosch	Mag	pos.	2902, 2941
	1916	IA6	Up to 8038	6	West	203	315	Bosch	Mag	pos.	2902, 2941
	1916	IA6	Above 8038	6	West	208	315	Bosch	Mag	pos.	2902, 2941
	1917, 18	IB6, IC6	8141–8391	6	West	208	318	Bosch	Mag	pos.	2902, 2941
	1919	6-80	Up to 8501	6	West	760	700	Bosch	Mag	pos.	2911, 2941
	1920, 21	6-80	8502	6	West	760	751	Bosch	Mag	pos.	2911, 2941
Dort	1915, 16	4, 5		4	Spl'f	A-25	6-12v M-G	Conn	GO	neg.	2307
	1916, 17	5A		4	West	400-SW2936	318	Conn	GO	pos.	2906, 2941
	1916, 17	5A		4	West	400	318	Conn	GO	pos.	2911, 2941
	1917, 18	6, 8, 9, 11, 19		4	West	760	100	Conn	GO	pos.	2911, 2941

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections
Dort	1919	39, 39L		4	G & D	636	525	Conn	M	pos.	1308
(Continued)	1920, 21	10, 12, 15, 17		4	West	33-AT	33-AB	Conn	M	pos.	2911, 2941
Drexel	1916	R-30		4	Bijur	L-61	E68	Bosch	Mag.	two	403, 441
	1917	B-30, S-30		4	Bijur	L-61	F65	Bosch	Mag.	two	403, 441
DuPont	1920, 21	A		4	West	150	100	Eise'n	Mag.	pos.	2911, 2941
Earl	1922			4	Auto-L	GJ	MH	Conn	M	pos.	305, 341
Economy	1917-19			4,6,8	Dyneto	CA	DA	Conn	GA	neg.	1010
Edwards-Knight	1913	25		4	U.S.L	12-24v	M-Gen	Simms	Mag.	two	2501
Elcar	1915	A		4	Spl'f	A-25	6-12v M-G.	Delco	2118	neg.	2307
	1916	B, C		4	Dyneto	VA	UA	Delco	2118	neg.	1008
	1917, 18	E6, F6, G6	Rutenber 25 Eng.	6	Dyneto	CA	DA	Delco	2118	neg.	1010
	1918, 19	D, E, G, H	Lycoming Eng.	4	Dyneto	CA	DA	A Kent	CC	neg.	1010
	1918, 19	D6	Cont'l 7W Eng.	6	Dyneto	CA	DA	A Kent	CC	neg.	1010
	1920	D, G, H, K		4,6	Delco	165	164	Delco	2159	neg.	726
	1921	G, H, K		6	Delco	176	177	Delco	2159	neg.	726
Elgin	1916	E-16		6	Dyneto	VA	UA	Delco	2138	neg.	1008
	1917	E-17		6	Wagner	EM165	EM180	Remy	171	pos.	2703
	1918	E-18, F		6	Wagner	EM200	EM218	Remy	284B	pos.	2703
	1919	Ser. H		6	Wagner	EM200	EM218	Wagner	K-32	pos.	2703
	1920	Ser. K		6	West	150	100	Wagner	KD-262	pos.	2911, 2941
	1920, 21	Ser. K, K1		6	Wagner	EM316,EM362	EM298	Wagner	KD-143C	pos.	2703
Elkhart			See Crow-Elkhart and Elcar.								
Emerson	1917			4	Spl'f	GU-2	SUB-6	A Kent	CC	pos.	2305
Empire	1914	31		4	Remy	SL-2	M-Gen	Conn	GO	neg.	2006
	1915	31, 33, 40		4	Remy	129A	M-Gen	Remy	49A	neg.	2004
	1916, 17	40, 45		4	Auto-L	GF	MC	Conn	GA	neg.	302, 341
	1916, 17	60, 60R		6	Auto-L	GG	ME	Conn	GO	neg.	303, 341
	1917, 18	50, 51		4	Auto-L	GF	MF	Conn	GA	neg.	302, 341
	1918	70, 70A, 71, 73		6	Auto-L	GG	ME	Conn	GA	neg.	303, 341

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting Sysetm	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Enger	1913, 14	A, B, C, G, P		4	N East	A-1080	M-Gen	Remy	Mag	two	1701	*En*
	1915, 16	6-50		6	G & D	T	Y	A Kent	K-2	pos.	1303	
	1916, 17	12		12	West	400	318	Remy	179A,B	pos.	2906, 2941	
Erie	1916			4	Dyneto	VA	UA	Conn	GO	neg.	1008	
	1917, 18	PMM		4	Dyneto	CA	DA	Conn	GA	neg.	1010	
Essex	1919	A	Up to 10,000 Cars	4	Delco	133	130	Delco	2127	neg.	724	
	1920, 21	A	Above 10,000	4	Delco	166	161	Delco	2127	neg.	724	
Fageol	1918	H-S		6	Bosch	DSG-7	DSR-3	Dixie	Mag	pos.	503, 2151	
Farmac	1916			4	A-Chal	MG	M-Gen	Dixie	Mag	neg.	126	
	1917			4	Bijur	L-61	F-65	Dixie	Mag	neg.	403, 441	
Ferris	1919-21	Ser. C-20	Cont'l 9N Eng.	6	Leece-N	G338, G350	347M	Spl'f	Mag	pos.	1404, 1441	
F. I. A. T.	1913			4, 6	G & D	E		Bosch	Mag	pos.	1301	
	1914, 15	54, 55, 56		4, 6	West	202		Bosch	Mag	pos.	2902	
	1915	50, 55		4, 6	Rush	1	Rush	Bosch	Mag	pos.	2151	
	1916	55, 56		4, 6	West	230	315	Bosch	Mag	pos.	2902, 2941	
	1917	55, 56		4, 6	G & D	258	140	Bosch	Mag	pos.	1305	
	1917	E-17		4, 6	West	260	318	Bosch	Mag	pos.	2902, 2941	
	1917, 18	G-3		6	Bosch	DSG-5	C-18	Bosch	Mag	pos.	503, 2151	
Firestone-Columbus	1912			4	Ward L	R-M	R-M	Spl'f	Mag	two	2801	
	1913, 14	60, 86, 90		4, 6	N East	A-2000	M-Gen	A Kent	F	two	1701	
	1914, 15	82E, 86E		4	G & D	S	Y	Dixie	Mag	pos.	1303	
	1914, 15	90E, 98E		6	G & D	T	Y	Conn	GO	pos.	1303	
	1915			4	West	251	750	Conn	GO	pos.	2902, 2941	
	1916			4	West	251R	750	Conn	GA	pos.	2906, 2941	
Fisher	1915			4,6	Remy	14A, 14B	5A	Remy	170A	neg.	2002, 2041	
Flanders	1913	40, 50		6	G & D	G-1	K	Spl'f	Mag	two	1301	
Flyer	1914	A		4	Ward L	F	None	A Kent	K-2	two	2801	
Ford	1918-21	T		4	Liberty	FA		Ford	Mag	neg.	1201	*Fo*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections
Ford (Extra)	1914, 15	Allis-Chalmers		4	A-Chal	MG-6	M-Gen	Ford	Mag	neg.	126
	1916, 17	Detroit Ward Leonard		4	Detroit	RS	M-Gen	Ford	Mag	two	901
	1915–18	Disco		4	Disco	26, 28	M-Gen	Ford	Mag	pos.	953
	1914	Dyneto		4	Dyneto	B	M-Gen	Ford	Mag	two	1003
	1915–18	Dyneto		4	Dyneto	A, B	M-Gen	Ford	Mag	neg.	1004
	1914, 15	Gray & Davis		4	G & D	9, 300	M-Gen	Ford	Mag	pos.	1304
	1914, 15	Gray & Davis		4	G & D	S	Y	Ford	Mag	pos.	1303
	1916–18	Gray & Davis		4	G & D	410	413	Ford	Mag	pos.	1307
	1914–17	North East		4	N East	D1210, D1252	M-Gen	Ford	Mag	pos.	1704
	1914, 15	Simms-Huff		4	Simms-H	HB	M-Gen	Ford	Mag	neg.	2201
	1914, 15	Splitdorf-Apelco		4	Spl'f	A-25	12-12v M-G	Ford	Mag	neg.	2307
	1915, 16	Splitdorf-Apelco		4	Spl'f	A-25	6-12v M-G	Ford	Mag	neg.	2307
	1916, 17	Westinghouse		4	West	600	M-Gen	Ford	Mag	pos.	2921
Franklin	1913	D,H,M. Ser. 2, 3, 4, 5		6	Dyneto	Entz	M-Gen	Bosch	Mag	two	1001
	1914	M, Ser. 6		6	Dyneto	A	M-Gen	Eise'n	Mag	two	1003
	1914, 15	M, Ser. 7, 8		6	Dyneto	B	M-Gen	Eise'n	Mag	two	1003
	1915, 16	Ser. 8		6	Dyneto	B	M-Gen	Eise'n	Mag	two	1004
	1917-19	Ser. 9A, 9B		6	Dyneto	B	M-Gen	A Kent	K-2	two	1004
	1920, 21	Ser. 9B		6	Dyneto	K1R	M-Gen	A Kent	K-2	two	1006
F. R. P			See Porter.								
Galt	1913			4	N East	A-1000	M-Gen	Bosch	Mag	two	1701
Gardner	1920	G	1000-2476,2890,2990-2996	4	West	760	100	West	SC	pos.	2911, 2941
	1920, 21	G	2477-2889,2891-2989,2997	4	West	35-AT	33-AB	West	SC	pos.	2911, 2941
Garford	1913	G-15		6	U.S.L	12-24v	M-Gen	Bosch	Mag	two	2501
Gay	1915			4	A-Chal	MG	M-Gen	A Kent	K-2	neg.	126
Geronimo	1918–21			4,6	Dyneto	CA	DA	Delco	2138	pos.	1010
Gersix	1916			6	West	400	750	West	Vert	pos.	2906, 2941
Ghent	1918	6-60		6	Auto-L	GH	MF	Conn	GA	neg.	304, 341
Glide	1912			4	Ward L	F	R-M	Bosch	Mag	two	2801
	1913	36, 42		4	West	260	502	West	Sep'te	pos.	2902, 2941

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Glide	1914, 15	30		4	West	230	300	West	Hor'l	pos.	2902, 2941	*Gl*
(Continued)	1916, 17	6-40		6	West	400	318	West	Vert	pos.	2906, 2941	
	1918, 19	6-40		6	West	760	710	West	Vert	pos.	2911, 2941	
Grant	1914–16	M, T, V		4,6	A-Chal	MG-4	M-Gen	A Kent	K-2	neg.	126	
	1917	K		6	Wagner	EM165	EM199	Remy	171	pos.	2703	
	1918, 19	G, GX		6	Wagner	EM189, 189A	EM166	Remy	284B	pos.	2703	
	1919	GX		6	Bijur	L-61	E68	A Kent	CC	pos.	404, 441	
	1920, 21	H, HX, HY, HZ		6	Bijur	P-230	FD140	A Kent	CC	pos.	405, 441	
Gray-Dort			See Dort.									
Great Eagle	1913	B		4	Auto-L	C-60	M	Eise'n	Mag	two	301, 341	
Great Western	1914	A		4	G & D	C-1	H-1	Remy	171A	pos.	1302	
	1915	B		4	Rush	2	Rush	Remy	171A	pos.	2151	
Grout	1913	35, 45		4	Ward L	F	WL	Bosch	Mag	two	2801	
Hackett	1916, 17	A		4	Dyneto	CA	DA	Conn	GA	neg.	1010	
	1918	AL		4	Dyneto	CA	DA	Conn	GO	neg.	1010	
	1919, 20	H-S	Lorraine	4	West	760	751	A Kent	CC	pos.	2911, 2941	
H. A. L	1917, 18	21, 25		12	West	450	750, 751	Remy	179B	pos.	2906, 2941	
	1919, 20			12	G & D	630	521, 708	Remy	284B	pos.	1308	
Halladay	1912, 13	G, 32, 35		4	Electro	Ign-Gen	M-Gen	Bosch	Mag	two	1075	
	1913	40		4	Jesco	3-13	M-Gen	Bosch	Mag	two	1351	
	1914			4	West	261	380	West	Sep'te	pos.	2902, 2941	
	1914			6	West	221	380	West	Sep'te	pos.	2902, 2941	
	1915	R, 6-40		6	West	240	310	West	Hor'l	pos.	2902, 2941	
	1916, 17	R-2, 6-40		6	West	400	318	West	Vert	pos.	2906, 2941	
	1917	S		6	Auto-L	GG	ME	Conn	GA	neg.	303, 341	
	1918	S, T, R		6	Auto-L	GH	ME	A Kent	CC	neg.	304, 341	
Hamilton	1919			4	Auto-L	GA	ME	Conn	GA	neg.	302, 341	
Handley-Knight	1921	A		4	Auto-L	GK	MH	Conn	XA	pos.	305, 341	*Ha*

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Hanson	1918, 19	45		6	Auto-L	GH	ME	Remy	287A	neg.	304, 341	*Ha*
	1920		Up to 2850	6	Delco	165	164	Delco	2159	neg.	726	
	1921, 22		Above 2850	6	Delco	165	181	Delco	2159	neg.	726	
Harroun	1918, 19	AA1		4	Remy	233A	305A	A Kent	CC	neg.	2010, 2041	
	1920, 21	AA2		4	Remy			Remy		neg.	2010, 2041	
Harvard	1917, 18	T		4	Wagner			A Kent	K-2	pos.	2703	
	1919, 20			4	Dyneto	CA	DA			neg.	1010	
Hassler	1917, 18			4	Auto-L	GF	ME	Conn	GA	neg.	302, 341	
Hatfield	1916-19	H, H-S		4	Dyneto	CA	DA	Conn	GA	neg.	1010	
	1920, 21	A42, B42, C42		4	Dyneto	CA	DA	Conn	M	neg.	1010	
Havers	1913	55		6	N East	A-2000	M-Gen	Eise'n	Mag	two	1701	
	1914	44, 60		6	N East	B-1102	M-Gen	Eise'n	Mag	two	1702	
Haynes	1913	22, 23, 24		4	Leece-N	1223		Eise'n	Mag	two	1401	
	1914	26, 27, 28		4,6	Leece-N	1223		Simms	Mag	two	1401	
	1915, 16	30 to 35		4,6	Leece-N	CR-400	B-300	Remy	48A	two	1402	
	1917	36, 37, 36R		6	Leece-N	C-400	B-300	Remy	280A	two	1404	
	1917	40, 40R, 41		12	Leece-N	C-400	B-300	Delco	2144	two	1404	
	1918	38, 39		6	Leece-N	E-400	186M	Remy	280A	two	1404, 1441	
	1918-20	44, 46		12	Leece-N	E-400	186M	Delco	2144	two	1404, 1441	
	1918	39		6	Leece-N	E-400	165M	Remy	284B	two	1404, 1441	
	1919, 20	45		6	Leece-N	E-400	186M	Kingston		two	1404, 1441	
	1920	47		6	Leece-N	G326	318M	Kingston		pos.	1404, 1441	
	1920	48		12	Leece-N	G109	166M	Delco	2144	two	1404, 1441	
	1921	55		6	Leece-N	G377	388M	Kingston		pos.	1404, 1441	
	1922	75		6	Leece-N	G382	380M	Kingston		pos.	1404, 1441	
H. C. S	1920-22	Ser. 2, 3		4	Delco	186	185	Delco	2170	neg.	727	
Henderson	1914			4	Ward L	BL	R-M	Eise'n	Mag	two	2801	
	1913, 14			6	Ward L	DH	DH	Eise'n	Mag	two	2801	
Herff-Brooks	1915	40, 50		4,6	Spl'f	A-25	12-12v M-G	Bosch	Mag	neg.	2307	
	1916	35, H-50		4,6	Spl'f	A-25	6-12v M-G	Dixie	Mag	neg.	2307	*He*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections
Hercules	1915			4	Remy	129A	M-Gen	Remy	49A	neg.	2004
Herreshoff	1914	6-40		6	West	220	510	West	Sep'te	pos.	2902, 2941
	1914, 15	4-16, 4-30		4	West	210	510	West	Sep'te	pos.	2902, 2941
Hollier	1916, 17	166, 176, 186		6	A-Chal	MG	M-Gen	Remy	171A	neg.	126
	1916-19	158, 168, 178, 188,198		8	Spl'f	A-25	6-12v M-G	A Kent	K-2	neg.	2307
	1918, 19	196, 206		6	Spl'f	A-25	6-12v M-G	Remy	284A	neg.	2307
	1920	206B		6	West	760	700	West	Vert	pos.	2911, 2941
Holmes	1919-21	Ser. 1, 2, 3, 4		6	Dyneto	K4R	M-Gen	Eise'n	Mag	two	1006
Homer Laughlin	1917, 18	D		8	Disco	28	M-Gen	A Kent	K-2	pos.	953
Howard	1913	B, C		6	Electro	Ign-Gen	M-Gen	Electro		two	1075
	1914	D		6	Jesco	5358	M-Gen	A Kent	K-2	two	1352
	1915			6	Jesco	7-NU	M-Gen	A Kent	K-2	pos.	1353
Howard	1917		Cont'l Eng	6	Delco	101	102	Delco	2139	neg.	724
Hudson	1913	37		4	Delco	2	M-Gen	Delco	2095	two	701
	1913	54		6	Delco	2	M-Gen	Delco	2097	two	701
	1914, 15	54		6	Delco	20	M-Gen	Delco	2101	neg.	704
	1914	6-40		6	Delco	31, 60	M-Gen	Delco	2108,13	neg.	706
	1915	6-40		6	Delco	45	M-Gen	Delco	2112	neg.	710
	1916	6-40, G		6	Delco	66	M-Gen	Delco	2116	neg.	710
	1917, 18	H, J	Super-Six	6	Delco	82	M-Gen	Delco	2127	neg.	721
	1919	M	Super-Six	6	Delco	140	M-Gen	Delco	2127	neg.	721
	1920	O	Super-Six	6	Delco	140	M-Gen	Delco	2170	neg.	721
	1921	O	Super-Six	6	Delco	188	M-Gen	Delco	2170	neg.	721
Huffman	1919, 20	6		6	Dyneto	CA	DA	Conn	M	neg.	1010
Hupmobile	1914	HA		4	West	201	300	Bosch	Mag	pos.	2902, 2941
	1915	K		4	West	600	M-Gen	A Kent	K-2	pos.	2921
	1916	N		4	Bijur	L-61	E-68	A Kent	K-2	pos.	403, 441
	1917	N		4	West	400	700	A Kent	K-3	pos.	2906, 2941
	1918, 19	R		4	Bijur	P-210	FD-140	A Kent	K-3	pos.	404, 441
	1919, 20	R		4	Remy	234C	305E,700A	A Kent	CC	pos.	2010, 2041

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Hupmobile (Continued)	1920, 21	R		4	West	760	33-AB	A Kent	CC	pos.	2911, 2941	*Im*
Imperial	1913	34, 44		4	N East	A-1000	M-Gen	Remy	Mag	two	1701	
	1914	32, 34, 39		4	N East	A-1080, 1103	M-Gen	Remy	Mag	two	1701	
	1914	44, 54		6	N East	B-1102	M-Gen	Remy	Mag	two	1702	
	1915	64		4	G & D	T	Y	A Kent	K-2	pos.	1303	
	1915	56		6	N East	B-1102	M-Gen	A Kent	K-2	two	1702	
	1916	64		4	West	450	318	West	Vert	pos.	2906, 2941	
	1916	66		6	West	400	318	West	Vert	pos.	2906, 2941	
Inter-State	1912, 13	50, 51, 52, 40, 41, 42		4	Aplco	A-7	M-Gen	Bosch	Mag	two	2302	
	1913, 14	45		6	Aplco	A-7	M-Gen	Mea	Mag	two	2302	
	1915	TF		4	Remy	16B	184A	Bosch	Mag	neg.	2007	
	1916, 17	T		4	Remy	18A	117A	Remy	170A	neg.	2007	
	1918	T		4	Remy	18C, 18D	184A	Remy	170A	neg.	2007	
Jackson	1913			4,6	Auto-L	C-60	M	Remy	Mag	two	301, 341	
	1914, 15	44		4	Auto-L	GA	MF	Conn	GO	neg.	302, 341	
	1914, 15	45		4	Auto-L	GF	MC	Conn	GO	neg.	302, 341	
	1915	48	Six-Forty	6	Delco	59	M-Gen	Delco	2111	neg.	710	
	1916, 17	68, 348		8	Auto-L	GG	MC	Conn	GO	neg.	303, 341	
	1917, 18	349, 350		8	Auto-L	GD	ME	Conn	GO	neg.	303, 341	
	1920, 21	6-38		6	Auto-L	GJ	MH	Remy	284B	neg.	305, 341	
Jeffery	1914, 15	93, 104		4	U.S.L	6-12v	M-Gen	Bosch	Mag	two	2501	
(See Nash)	1914, 15	96, 106		6	U.S.L	12-24v	M-Gen	Bosch	Mag	two	2501	
	1915	32	Chesterfield	6	Bijur	K-634	A-35	Bosch	Mag	two	401, 441	
	1916	661		6	Bijur	L-61	E-68	Bosch	Mag	pos.	403, 441	
	1916, 17	462, 472		4	Bijur	L-61	E-68	Bosch	Mag	pos.	403, 441	
	1917	671		6	Bijur	L-61	F-65	Bosch	Mag	pos.	403, 441	
Jones	1914	23		6	Leece-N	1223				two	1401	
	1915	24		6	Leece-N	CR-400	DR500-5	Remy	175A	neg.	1402	
	1916, 17	25, 26		6	G & D	200	136	Remy	175A	pos.	1305	
	1918-20	26, 28		6	Auto-L	GH	ME	Conn	GO	neg.	304, 341	
	1920, 21			6	West	760	751	Conn	M	pos.	2911, 2941	
Jordan	1916, 17	B		6	Bijur	L-61	E-68	Bosch	Mag	pos.	403, 441	
	1918, 19	C, F		6	Bijur	L-61	ED-160	Delco	2159	pos.	404, 441	
	1920	F, Ser. 2	After 1500 cars	6	Delco	180	179	Delco	2159	neg.	726	*Jo*

CAR INDEX—*Continued*

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Jordan	1919, 20	M		6	Delco	165	164	Delco	2159	neg.	726	*Jo*
(Continued)	1921	M	Cont'l 7R Eng	6	Delco	165	181	Delco	2159	neg.	726	
King	1913	B		4	Ward L.	DC	DH	A Kent.	K-2	two	2801	
	1914	C		4	Ward L.	F	DH	A Kent.	K-2	two	2801	
	1915	D		8	Ward L.	RID	RS	A Kent.	K-2	two	2801	
	1916	E		8	Ward L.	R-M	R-M	A Kent.	K-2	pos.	2801	
	1917, 18	EE		8	Bijur	L-61	ED-160	A Kent.	CC	pos.	403, 441	
	1918, 19	F, G		8	Bijur	L-61	ED-160	A Kent.	CC	pos.	404, 441	
	1920, 21	H, J		8	West	150	101	A Kent.	CC	pos.	2911, 2941	
Kissell	1913, 14	D-13, D-14, 4-40		4	Ester	D-C	12v	Bosch	Mag.	two	1102	
	1914	F-14, H-14, 6-48, 6-60		6	Ester	D-B	6v	Bosch	Mag.	two	1102	
	1915	6-42		6	West	240		West	Hor'l.	pos.	2902	
	1915	6-48		6	West	203		Mea	Mag.	pos.	2902	
	1915	6-60		6	West	208		Bosch	Mag.	pos.	2902	
	1915, 16	4-36		4	West	280	310	West	Hor'l.	pos.	2902, 2941	
	1916	4-32		4	West	450	700	West	Vert.	pos.	2906, 2941	
	1916, 17	6-42		6	West	400	700	Eise'n.	Mag.	pos.	2906, 2941	
	1917, 18	Double Six		12	Delco	87	86	Delco	2123	neg.	724	
	1917, 18	100 Point		6	Remy	245B,245C	293B	Remy	172A	pos.	2007, 2041	
	1918, 19	100 Point		6	Remy	230B,230E	303C	Remy	284B, C	pos.	2010, 2041	
	1920, 21	Custom 6		6	Remy	912A	715A	Remy	284A	pos.	2010, 2041	
Kline	1913, 14	30, 40, 50, 60		4,6	Rush	1	Rush	Bosch	Mag.	two	2151	
	1915-18	36, 38, 42		6	West	400	318	West	Vert.	pos.	2906, 2941	
	1919	6-42		6	West	760	750	Conn	GA	pos.	2911, 2941	
	1919	55		6	Wagner	EM305	EM320	Conn	GA	pos.	2703	
	1920, 21	55-J, 55-K		6	Wagner	EM305	EM368, EM379	Conn	M	pos.	2703	
Knox	1914	44, 45, 46, 66		4,6	Ester	D-C		Bosch	Mag.	two	1102	
Krit	1914	L		4	Disco	12v		Remy	48A	two	976	
	1915	M		4	N East	D-1255	M-Gen	Bosch	Mag.	two	1704	
	1915, 16	10A, 10S		4	Disco	30		Remy	48A	two	980	
Lafayette	1921	134		8	Delco	187	M-Gen	Delco	2115	pos.	731	*La*

CAR INDEX—*Continued*

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Section	
Lambert	1914, 15	46C, 48C		4	Remy	14C	117A	Remy	170A	two	2002, 2041	***La***
	1915, 16	80		6	Remy	161A	180A	Remy	172A	two	2007, 2041	
	1916, 17	90		4	Remy	OB	184A	Remy	O	two	2002, 2041	
Laurel	1916, 17	35		4	Disco	100	200	Dixie	Mag.	neg.	957	
Leach	1920, 21	A, B		6	Delco	180	179	Delco	2159	neg.	726	
Lenox	1913, 14	AC, DC, A, D		4	G & D	G-1, E	H	Spl'f	Mag.	two	1301	
	1913, 14	MC, M		6	G & D	G-1	H	Mea	Mag.	two	1301	
	1915, 16	D		4	West	450	318	West	Vert.	pos.	2906, 2941	
	1915, 16	O		6	West	400	318	West	Vert.	pos.	2906, 2941	
	1916, 17	O		6	Bijur	L-61	E-68	Bosch	Mag.	pos.	403, 441	
Lewis			See L. P. C.									
Lexington	1913, 15	Six	See Howard.									
	1915	K		4	West	230	300	West	Hor'l	pos.	2902, 2941	
	1915	M	M	6	Jesco	7-NU	M-Gen	Conn	GO	pos.	1353	
	1915, 16	L		6	West	240	310	West	Hor'l	pos.	2902, 2941	
	1916	N		6	West	208R	700	Bosch	Mag.	pos.	2905, 2941	
	1916	O, 6-O-16		6	West	400	318	Conn	GO	pos.	2906, 2941	
	1917, 18	O, OO, P		6	West	400	318	Conn	GA	pos.	2906, 2941	
	1918	R		6	West	760	710	Conn	GA	pos.	2911, 2941	
	1919	R-19		6	G & D	605	510	Conn	GA	pos.	1308	
	1920	S		6	G & D	631	510	Conn	MA	pos.	1308	
	1921	T		6	G & D	634, 635	522	Conn	MA	pos.	1308	
Liberty	1917	10A		6	Delco	105	107	Delco	2139	neg.	724	
	1918, 19	10-B		6	Wagner	EM277	EM266, 266A	A Kent	CC	pos.	2703	
	1920, 21	10-C		6	Wagner	EM339	EM362, 382	Wagner	K-42	pos.	2703	
Lincoln	1921			8	Delco	193	M-Gen	Delco	2159	neg.	731	
Locomobile	1911–13	L, M1, M2, R1	30, 38, 48	4,6	Rush	1	gas	Bosch	Mag.	two	2151	
	1913	L, M3, R2	30, 38, 48	4,6	Adlake		Newbold	Bosch	Mag.	two	101	
	1914	R3, M4	38, 48	6	West	520	310	Bosch	Mag.	pos.	2903, 2941	
	1915	R5, M5	38, 48	6	West	521	311	Bosch	Mag.	pos.	2903, 2941	
	1916	R6, M6	38, 48	6	West	521	775	Bosch	Mag.	pos.	2903, 2941	***Lo***

CAR INDEX—*Continued*

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections
Locomobile	1917	R7, M7, Ser. 1	38, 48	6	West	521	775	Eise'n	Mag	pos.	2903, 2941
(Continued)	1918	Ser. 2, 3	38, 48	6	West	521	775	Bosch	Mag	pos.	2903, 2941
	1919–21	Ser. 4, 5, 6, 7	48	6	West	760	775, 777	Berling	Mag	pos.	2911, 2941
Lorraine	1921	T		4	West	765	33-AB	West	SC	pos.	2911, 2941
	1919, 20		See Hackett.								
Louisiana			See Bour-Davis.								
Lozier	1913, 14	72, 77		6	G & D	G-1	H-1	Bosch	Mag	two	1301
	1914, 15	84		4	G & D	C-1	K-1	Bosch	Mag	pos.	1302
	1916, 17	82		6	G & D	C-1	H-2	Eise'n	Mag	pos.	1302
	1916, 17	6-50		6	West	400	318	West	Vert	pos.	2906, 2941
	1918–20		See H. A. L.								
L. P. C	1914		Lewis Six	6	Remy	SLO	M-Gen	Remy	48A	neg.	2006
	1915	V-1		6	Remy	152A	M-Gen	Remy	48A	neg.	2006
	1916	V-2		6	Remy	159A	M-Gen	Remy	177A	neg.	2005
Luverne	1914	760		6	G & D	C-1		Bosch	Mag	pos.	1302
	1915	760		6	Jesco	7-NU	M-Gen	Bosch	Mag	pos.	1353
	1916	760		6	Spl'f	A-29	6-12v M-G	Bosch	Mag	neg.	2307
	1917, 18	PM		4	Dyneto	CA	DA	Conn	GA	neg.	1010
Lyons-Knight	1914	K		4	N East	B-1106	M-Gen	Simms	Mag	two	1702
Madison	1916, 17	22	6-40	6	Remy	168A	186A	Remy	174A	neg.	2007, 2041
	1918			8	Remy	16C	180C	Remy	173A	neg.	2007, 2041
Maibohm	1917, 18	A		4	Disco	28	M-Gen	A Kent	K-S,CC	pos.	953
	1918, 19	B		6	Wagner	EM200	EM218	A Kent	CC	pos.	2703
	1920, 21	B		6	Bijur	P-230	FD-140	A Kent	CC	pos.	405
Marathon	1914		Runner, Winner	4	Jesco	5700	M-Gen	Remy	Mag	two	1352
	1914		Champion	4	Spl'f	A-25	12-12v M-G	Remy	Mag	two	2307
Marion	1913	A-48		4	Ward L.	AXL	CW	Spl'f	Mag	two	2801
	1913, 14	B, G		4,6	West	201, 202	501, 502	Spl'f	Mag	pos.	2902, 2941
	1914, 15	B		4	West	230	532	West	Hor'l	pos.	2902, 2941

CAR INDEX—*Continued*

CAR	Years	MODELS	Serial Numbers, Engine or Identification	ders ders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Marion-Handley	1916	K		6	West	400	318	West	Vert.	pos.	2906, 2941	*Ma*
	1916, 17	A, B	40, 60	6	West	400	700	A Kent	CC	pos.	2906, 2941	
Marmon	1913	32		4	N East	A-1000	M-Gen	Bosch	Mag.	two	1701	
	1913, 14	48		6	N East	B-1102	M-Gen	Bosch	Mag.	two	1702	
	1914	41		6	N East	B-1103	M-Gen	Bosch	Mag.	two	1702	
	1915, 16	41		6	Bosch		Rush	Bosch	Mag.	pos.	501	
	1916, 17	34		6	Bosch	DSG-7	DSR-3	Bosch	Mag.	pos.	503, 2151	
	1917–19	34		6	Bijur	K-643	AD-200	Bosch	Mag.	pos.	401, 441	
	1920, 21	34, 34-B		6	Delco	168	172	Delco	2135	pos.	727	
Mason	1914	L-4		4	Jesco	3418	M-Gen	Bosch	Mag.	two	1352	
Matheson	1913	C		6	West	240		West	Sep'te	pos.	2902	
Maxwell	1914	35		4	Deaco	SL	Deaco	Simms	Mag.	neg.	652	
	1914, 15	50		6	G & D	T	Y-1	Simms	Mag.	pos.	1303	
	1915	25	Up to–50000	4	Simms-H	HB	M-Gen	Simms	Mag.	neg.	2201	
	1916, 17	25	50000–135982	4	Simms-H	HK	M-Gen	Simms	Mag.	neg.	2201	
	1917	25	135983–913800	4	Simms-H	HK	M-Gen	A Kent	CC	neg.	2201	
	1918	25	193801–259825	4	Simms-H	HM	M-Gen	A Kent	CC	neg.	2202	
	1919	25	239826–	4	Simms-H	SMS	M-Gen	A Kent	CC	neg.	2202	
	1919	25	–266800	4	Simms-H	SMS-2	M-Gen	A Kent	CC	neg.	2203	
	1920	25	266801–328450	4	Simms-H	SMS-3	M-Gen	A Kent	CC	neg.	2203	
	1921	25	328451–	4	Simms-H	G	B	A Kent	CC	neg.	2205	
	1921	25	328451–	4	Auto-L	GJ	MH,MG	A Kent	CC	neg.	305, 341	
McFarlan	1914	T		6	Deaco	SL	Deaco	Mea	Mag.	neg.	652	
	1914	T	Up to–5000	6	West	240	390	West	Hor'l	pos.	2902, 2941	
	1915	T, X	7001–9000	6	West	400	750	West	Vert.	pos.	2906, 2941	
	1916	T, X	9001–10000	6	West	400	775	West	Vert.	pos.	2906, 2941	
	1917	120-127	10001–18000	6	West	450	775	West	Vert.	pos.	2906, 2941	
	1918–21	122-160	18001	6	West	781R	777	West	Vert.	pos.	2906, 2941	
McIntyre	1913, 14	G		6	West	201	300	West	Sep'te	pos.	2902, 2941	
	1915, 16	25		4	Spl'f	A-25	6-12v M-G	Bosch	Mag.	neg.	2307	
McLaughlin	1916	D-60		6	Remy	166A	114A	Remy	172A	neg.	2007, 2041	
	1917, 18	E-63		6	Remy	234A	307A	Remy	284C	neg.	2010, 2041	*Mc*

CAR INDEX—*Continued*

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
McLaughlin	1920, 21	K-62, K-63		6	Remy	911A	701A	Remy	284C	neg.	2010, 2041	*Me*
(Continued)	1921	Ser. 21, 44 to 50		6	Delco	184	M-Gen.	Delco	2159	neg.	717	
Mecca	1916	30		4	Disco	26	M-Gen	Dixie	Mag.	pos.	953	
Mercer	1914	35		4	Rush	1	Rush	Bosch	Mag.	neg.	2151	
	1914, 15	22-70		4	U.S.L.	E-177	M-Gen.	Bosch	Mag.	neg.	2504	
	1916	22-72		4	U.S.L.	E-197	M-Gen.	Bosch	Mag.	neg.	2504	
	1917	22-73		4	U.S.L.	E-207A	M-Gen.	Bosch	Mag.	neg.	2504	
	1917–19	22-74, Ser. 4		4	West	762-R	775	Berling.	Mag.	pos.	2917, 2941	
	1920	Ser. 5		4	West	760	776, 777	Berling.	Mag.	pos.	2911, 2941	
	1921	Ser. 5		4	West	760	778	Eise'n	Mag.	pos.	2911, 2941	
Meteor	1914	F, W		4,6	Jesco	5700	M-Gen	A Kent	K-2	two	1352	
	1914, 15	45		6	Spl'f	A-29	M-Gen	A Kent	K-2	neg.	2307	
	1915	42		4	Spl'f	A-25	M-Gen	A Kent	K-3	neg.	2307	
	1916	75, 80		6	Delco	101	102	Delco	2139,40,42	neg.	724	
	1917, 18	75A, 80A		12	Delco	87	86	Delco	2123	neg.	724	
	1918	75 to 92		6	Delco	135	136	Delco	2159	neg.	724	
	1919		Cont'l 7N Eng.	6	Delco	101	102	Delco	2158	neg.	724	
	1920		Cont'l 9N Eng.	6	Delco	135	136	Delco	2159	neg.	724	
	1920	R	Duesenberg Eng.	4	Bijur	K-646	AD-200	Simms	Mag.	pos.	401, 441	
	1921		Cont'l Eng.	6	Delco	180	179	Delco	2159	neg.	726	
	1921	RR	Duesenberg Eng.	4	West	765	100	Simms	Mag.	pos.	2911, 2941	
Metz	1913	22		4	N East	B-1106	M-Gen	Bosch	Mag.	two	1702	
	1914	22		4	N East	D1220, 1250	M-Gen	Bosch	Mag.	two	1704	
	1915	22		4	G & D	T	Y-1	Bosch	Mag.	pos.	1303	
	1916	25		4	G & D	228	125	Bosch	Mag.	pos.	1305	
	1917	25		4	G & D	270	153, 452	Bosch	Mag.	pos.	1305	
	1917, 18	G		4	West	450	700	A Kent	CC	pos.	2911, 2941	
	1919, 20	Ser. A	Master Six	6	West	760	100	Conn	GA	pos.	2911, 2941	
	1920, 21	Ser. B	Master Six	6	G & D	620	515	Conn	M	pos.	1308	
Michigan	1913	L, O, R, S		4	N East	A-2000	M-Gen	Briggs	Mag.	two	1701	
Midland	1914	T		4,6	G & D	C-1	K	A Kent	K	pos.	1302	
Mitchell	1913	4, 6		4,6	Ester	D-B		Bosch	Mag.	two	1102	
	1914	A-40, A-50, A-60		4,6	Remy	OB	6A	Remy	Mag.	two	2002, 2041	*Mi*

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Mitchell	1915	Spec. Six, Six De Luxe		6	Remy	129, SL3	M-Gen	Conn	G	neg.	2004, 2006	*Mi*
(Continued)	1915	B-35, B-45		4	Spl'f	A-29	M-Gen	Conn	G	two	2307	
	1915, 16	B-48, C-48		8	West	208	700	Conn	G	pos.	2902, 2941	
	1916	Six of Sixteen		6	Spl'f	A-29	6-12v M-G	Conn	GOM	two	2307	
	1917, 18	C-42	Mid-Year	6	West	400	700	Conn	GOM	pos.	2906, 2941	
	1916–18	D-40	Junior	6	Spl'f	RGU-1	RSUB-1	Conn	GA	pos.	2305	
	1919	C-42, E-40, E-42		6	Remy	232A	304A	Remy	284B	pos.	2010, 2041	
	1920, 21	E-40, E-42, F-40		6	Remy	910A	700C	Remy	284B	pos.	2010, 2041	
Moline	1913	M-30, M-40		4	Ward L.	AX	CW	Bosch	Mag.	two	2801	
	1914	M-40		4	Ward L.	DC	DH	Bosch	Mag.	two	2801	
Moline-Knight	1914–16	MK-50		4	Wagner	EM111	EM110	Bosch	Mag.	two	2702	
	1915, 16	MK-40		4	Wagner	EM153	A-Lt M	Conn	GO	neg.	2703, 341	
	1917	C-40		4	Wagner	EM153	A-Lt MC	Conn	GA	neg.	2703, 341	
	1917–19	G-50		4	Wagner	EM202	A-Lt MC	Bosch	Mag.	neg.	2703, 341	
	1918, 19	L		4	Wagner	EM202	A-Lt MC	Bosch	Mag	neg.	2703, 341	
	1920		See R. & V.									
Monarch	1914			4	Deaco	SL	Deaco	Spl'f	Mag.	neg.	652	
	1915			6	Ward L.	F		A Kent	K-2	neg.	2801	
Monitor	1916	C, R, N		4,6	Disco	28, 29	M-Gen	Dixie	Mag.	pos.	953	
	1917–19	M, O	Cont'l 7W Eng	6	Dyneto	CA	DA	Conn	GA	neg.	1010	
	1920, 21	M	Cont'l 7R Eng	6	Dyneto	CA	DA	Conn	M	neg.	1010	
Monroe	1915, 16	M2		4	Auto-L	GB	MF	Conn	GO	neg.	303, 341	
	1917	M3		4	Auto-L	GG	MF	Conn	GA	neg.	303, 341	
	1917-19	M4, M5, M6, S7, S8		4	Auto-L	GH	MF	Conn	GA	neg.	304, 341	
	1920, 21	S9, S10		4	Auto-L	GH	MF	Conn	M	neg.	304, 341	
Moon	1913	39, 48		4	Wagner	EM102, 103	M-Gen	Remy	Mag.	two	2701	
	1913	65		6	Wagner	EM104	M-Gen	Bosch	Mag.	two	2701	
	1914	42		4	Delco	39, 39B	M-Gen	Delco	2105	neg.	702	
	1914, 15	38		4	Delco	57	M-Gen	Delco	2111	neg.	710	
	1914, 15	50		6	Delco	39, 39B	M-Gen	Delco	2105	neg.	702	
	1914–16	40		6	Delco	58	M-Gen	Delco	2111	neg.	710	
	1915, 16	30		6	Delco	83	M-Gen	Delco	2124, 25	neg.	715	
	1916	44		6	Delco	73	M-Gen	Delco	2120	neg.	715	
	1916, 17	43		6	Delco	105	106	Delco	2139	neg.	724	
	1916–19	66		6	Delco	101	102	Delco	2139, 58	neg.	724	*Mo*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Moon	1917	45		6	Delco	105	106	Delco	2158	neg.	724	***Mo***
(Continued)	1917, 18	36		6	Wagner	EM155	EM167	Delco	2123	pos.	2703	
	1919	46	Victory	6	Wagner	EM303	EM272	Wagner	K-42	pos.	2703	
	1920	46		6	Wagner	EM341	EM272	Wagner		pos.	2703	
	1920	68		6	Delco	135	136	Delco	2159	neg.	724	
	1921	68		6	Delco	180	179	Delco	2159	neg.	726	
	1920–22	48		6	Delco	165	181	Delco	2159	neg.	726	
Moore	1916	30		4	Disco	30		Dixie	Mag.	neg.	980	
	1917, 18	30		4	Dyneto	CA	DA	Conn	GA	neg.	1010	
	1918	C-30		4	Auto-L	GH	ME	Conn	GA	neg.	304, 341	
	1919, 20	C-30		4	Auto-L	GH	ME	Conn	M	neg.	304, 341	
Morse	1914			4	G & D	C-1	K	Bosch	Mag.	pos.	1302	
	1915			4	G & D	S	Y	Eise'n	Mag.	pos.	1303	
	1916			4	G & D	200	100	Eise'n	Mag.	pos.	1305	
Moyer	1914	E, G		4,6	U.S.L	12-24v	M-G n	Mea	Mag.	two	2501	
Murray	1917, 18	T		8	West			Dixie	Mag.	pos.	2906	
Napoleon	1917	30		4	Dyneto	CA	DA	Conn	GA	neg.	1010	
Nash	1918	681 to 685		6	Delco	125	126	Delco	2163	neg.	724	
	1919	681 to 687		6	Wagner	EM278	EM279	Wagner	K-32	pos.	2703	
	1920, 21	41 to 44		4	Wagner	EM337	EM353	Wagner	K-32	pos.	2703	
	1920, 21	681 to 687		6	Wagner	EM337	EM353	Wagner	K-32	pos.	2703	
National	1913, 14	V		4	G & D	G-1	H-1	Bosch	Mag.	two	1301	
	1913, 14	W		6	Deaco	SL	Deaco	Remy	Mag.	two	652	
	1914	AA		6	Remy	150A	M-Gen	Eise'n	Mag.	two	2005	
	1915, 16	AB	Newport	6	West	202	310	Eise'n	Mag.	two	2902, 2941	
	1916–18	AC, AF1, AF2	Highway	6	West	208	700	Dixie	Mag.	two	2902, 2941	
	1916	AD		12	West	450	310	Dixie	Mag.	two	2911, 2941	
	1917	AH		12	Bijur	L-61	F-68	Delco	2152	pos.	403, 441	
	1918, 19	AK, AM		12	Bijur	L-61	E-68	Delco	2152	pos.	404, 441	
	1919–21	AF3, AL, BB	Highway, Sextet	6	West	760	751	Delco	2159	pos.	2911, 2941	
Nelson	1918-20	D		4	U.S.L	12-12v	M-Gen	Bosch	Mag.	neg.	2504	***Ne***

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
New Era	1916			4	A-Chal	MG	M-Gen	A Kent	K-2	neg.	126	*Na*
Noma	1919	Ser. A, B, Mod. 1	Cont'l 7W Eng	6	Delco	105	106	Delco	2158	neg.	724	
	1920, 21	Ser. C, Mod. 1	Cont'l 7R Eng	6	Delco	165	181	Delco	2159	neg.	726	
Norwalk	1913	A	Underslung	6	G & D	E	H-1	A Kent	H	two	1301	
	1914	C	Underslung	6	West	202, 250	310	A Kent	K-2	pos.	2902, 2941	
	1914	D	Underslung	6	West	240	310	West	Hor'l	pos.	2902, 2941	
	1915	E, F	Underslung	6	G & D	T	Y	A Kent	K-2	pos.	1303	
Norwalk	1916, 17			4	Dyneto	CA	DA	Conn	GO	neg.	1010	
	1917, 18	DX		4	Dyneto	CA	DA	Delco	2118	neg.	1010	
	1918, 19	K		4	Dyneto	CA	DA	Delco	2138	neg.	1010	
Oakland	1913, 14	35		4	West	210, 260	300	West	Sep'te	pos.	2902, 2941	
	1913, 14	35, 42		4	Deaco	OX		Deaco	Ign-Gen	two	656	
	1914	35, 42		4	Deaco	SL	Deaco	Remy	Mag	neg.	652	
	1913	42		4	Delco	12	M-Gen	Delco	2045	two	701	
	1913	60		6	Delco	15	M-Gen	Delco	2094	two	701	
	1914	36		4	Delco	41	M-Gen	Delco	2106	neg.	706	
	1914	43		4	Delco	27, 27B	M-Gen	Delco	2105	neg.	702	
	1914	48, 62		6	Delco	37, 37B	M-Gen	Delco	2105	neg.	702	
	1915	37		4	Delco	49	M-Gen	Delco	2111	neg.	710	
	1915	49		6	Delco	50	M-Gen	Delco	2111	neg.	710	
	1916	38		4	Delco	68	M-Gen	Delco	2118	neg.	715	
	1916	50		8	Delco	91	72	Delco	2123	neg.	723	
	1916	32, 32B		6	Remy	166A	114A	Remy	172A	neg.	2007, 2041	
	1917	32B		6	Delco	99	100	Delco	2137	neg.	724	
	1916, 17	34		6	Delco	111	100	Delco	2137	neg.	724	
	1918, 19	34, 34B		6	Remy	234A	307A	Remy	284C	neg.	2010, 2041	
	1920, 21	34B, 34C		6	Remy	911A	701A	Remy	284C	neg.	2010, 2041	
Ogren	1920			6	Bijur	L-220	ED-160	Bosch	Mag	pos.	405, 441	
Ohio	1914			4,6	Jesco	5358	M-Gen	Spl'f	Mag	two	1352	
Oldsmobile	1913	53		6	Delco	15	M-Gen	Delco	2094	two	701	
	1914	54		6	Delco	37, 37B	M-Gen	Delco	2105	neg.	702	
	1914, 15	42		4	Delco	49	M-Gen	Delco	2105, 11	neg.	710	
	1915	55		6	Delco	54, 54B	M-Gen	Delco	2111	neg.	702	*Ol*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Oldsmobile	1916	43		4	Delco	75	M-Gen	Delco	2121	neg.	715	*Ol*
(Continued)	1916	44		8	Delco	91	72	Delco	2123	neg.	723	
	1917	37		6	Delco	111	100	Delco	2137	neg.	724	
	1917	45		8	Delco	113	72	Delco	2153	neg.	723	
	1917–19	37, 37A, 37B		6	Remy	234C	307A	Remy	284C	neg.	2010, 2041	
	1918	45A		8	Delco	134	72	Delco	2162	neg.	724	
	1919	45A		8	Delco	137	72	Delco	2162	neg.	724	
	1920, 21	45B, 46		8	Delco	167	178	Delco	2127	neg.	724	
	1920	37, 37A		6	Remy	911A	701A	Remy	284C	neg.	2010, 2041	
	1921	43A		4	Auto-L	GH	ME	Remy	287A	neg.	304, 341	
	1921	37A		6	Remy	917B	701A	Remy	284C	neg.	2010, 2041	
	1922	47		8	Delco	220	219	Delco	2127	neg.	724	
Olympian	1917			4	Auto-L	GH	ME	Conn	GA	neg.	304, 341	
	1918, 19	45		4	Dyneto	CA	DA	Conn	GA	neg.	2010	
	1920, 21	45		4	Auto-L	GJ	MG	Conn	M	neg.	305, 341	
Overland			See also Willys, Willy-Knight.									
	1913	69, 71		4	Auto-L	C-60	None	Remy	Mag	two	301	
	1913	69, 71		4	U.S.L	12-24v	M-Gen	Bosch	Mag	two	2501	
	1914	79		4	G & D	C-1	K	Bosch	Mag	pos.	1302	
	1915	80, 81		4	Auto-L	GC	MC	Bosch	Mag	neg.	303, 341	
	1915	82		6	Auto-L	GA	MD	Bosch	Mag	neg.	302, 341	
	1916	75	Up to 33,850	4	Auto-L	GB	MF	Dixie	Mag	neg.	303, 341	
	1916	75	Above 33,850	4	Auto-L	GB	MF	Conn	GA	neg.	303, 341	
	1916	86		6	Auto-L	GA	MD	Dixie	Mag	neg.	302, 341	
	1916, 17	86, 86B		6	Auto-L	GA	MD	Conn	GA	neg.	302, 341	
	1916	83		4	Auto-L	GF	MC	Dixie	Mag	neg.	302, 341	
	1917, 18	83		4	Auto-L	GD	MC	Dixie	Mag	neg.	303, 341	
	1917, 18	85-4		4	Auto-L	GD	MC	Conn	GA	neg.	303, 341	
	1917, 18	85-6	Up to 13,800	6	Auto-L	GG	ME	Conn	GA	neg.	303, 341	
	1917, 18	85-6	Above 13,800	6	Auto-L	GH	ME	Conn	GA	neg.	304, 341	
	1917–19	90		4	Auto-L	GH	MF	Conn	GA	neg.	304, 341	
	1919–21	Four		4	Auto-L	GK	MG	Conn	GA, M	neg.	305, 341	
Packard	1912, 13	1-48		6	Bijur	K-643	A-42	Bosch	Mag	two	401, 441	
	1913	2-48		6	Bijur	D-12	None	Bosch	Mag	two	402	
	1913	3-48, 1-38		6	Delco	3	M-Gen	Bosch	Mag	two	703	
	1914	3-48		6	Delco	19	M-Gen	Bosch	Mag	two	703	
	1914, 15	2-38, 3-38		6	Bijur	H-62	B-63	Bosch	Mag	two	401, 441	*Pa*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Packard	1914, 15	4-48, 5-48		6	Bijur	H-67	B-63	Bosch	Mag.	two	401, 441	*Pa*
(Continued)	1916, 17	1-25, 1-35, 2-25, 2-35		12	Bijur	K-646	A-44	Delco	2131, 35	two	401, 441	
	1918	3-25, 3-35		12	Bijur	K-646	E-160	Delco	2150	pos.	401, 441	
	1919–21	3-25, 3-35		12	Bijur	K-646	ED-160	Delco	2150	pos.	401, 441	
	1920, 21	1-16		6	A Kent	7418	6324	Delco	2150	pos.	201	
Paige	1913	36		4	G & D	G-1	H-1	Bosch	Mag.	two	1301	
	1914	36		4	G & D	G-1	H-1	A Kent	K-2	two	1301	
	1914	25		4	Disco	5-E	5-E	Bosch	Mag.	two	951	
	1915	36		6	G & D	S	Y	Remy	175	pos.	1303	
	1915, 16	46		6	G & D	400, 413	120	Remy	175	pos.	1307	
	1916	38		6	G & D	431	450	Remy	175	pos.	1307	
	1916, 17	46		6	G & D	222, 240, 250	120, 124	Remy	175	pos.	1305	
	1917	51		6	Remy	257A	298A	Remy	285B	pos.	2010, 2041	
	1918, 19	55		6	Remy	257B	306A	Remy	284B	pos.	2010, 2041	
	1917, 18	39		6	G & D	415, 417	468	Remy	284B	pos.	1307	
	1919	42		6	G & D	605	502	A Kent	CC	pos.	1308	
	1919	55		6	G & D	605	503, 523	A Kent	CC	pos.	1308	
	1920	66, M-18		6	G & D	606	700	A Kent	CC	pos.	1308	
	1920	15-19		6	G & D	630	708	A Kent	CC	pos.	1308	
	1921	42		6	Remy	913E	721A	A Kent	CC	pos.	2010, 2041	
	1921	66		6	Remy	913E	705C	A Kent	CC	pos.	2010, 2041	
Palmer-Singer			See Singer.									
Pan	1917, 18	250		4	Remy	18C	294C	Remy	170A	neg.	2007, 2041	
	1919, 20	A		4	Auto-L	G	MG	A Kent	CC	neg.	305, 341	
Pan-American	1917, 18	G4, G5, G7	Rutenber Eng	6	Dyneto	CA	DA	Remy	284B	neg.	1010	
	1919, 20	6-48	Cont'l Eng	6	West	760	711	A Kent	CC	pos.	2911, 2941	
	1921	6-55	Hers-Splman Eng	6	West	760	100	A Kent	CC	pos.	2911, 2941	
Partin-Palmer	1914	20-38		4	A-Chal	MG	M-Gen	A Kent	H	neg.	126	
	1915	32		4	G & D	T	Y	Conn	GO	pos.	1303	
	1916	4-40		4	Disco	100	200	Conn	GO	pos.	957	
	1917		See Commonwealth.									
Paterson	1913	43, 47		4	Deaco	Ign-Gen		Deaco		two	656	
	1914	32, 32B, 33		4	Delco	41	M-Gen	Delco	2106	neg.	706	
	1915	4-32		4	Delco	64	M-Gen	Delco	2111	neg.	710	*Pa*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Paterson	1915	48		6	Delco	59	M-Gen	Delco	2111	neg.	710	*Pa*
(Continued)	1916	42		6	Delco	84	85	Delco	2123, 34	neg.	724	
	1917	45, 45R		6	Delco	105	106	Delco	2139	neg.	724	
	1918–20	46		6	Delco	105	106	Delco	2158	neg.	724	
	1920, 21	47		6	Delco	165	164	Delco	2159	neg.	726	
Pathfinder	1913, 14	14		4	G & D	G-1	H-1	Eise'n	Mag	two	1301	
	1914	6-B		6	Deaco	SL	SL	Mea	Mag	two	652	
	1914	6-L		6	West	400	318	West	Vert	pos.	2906, 2941	
	1915	7A, 7B, 7C		6	West	240	750	West	Hor'l	pos.	2902, 2941	
	1916, 17	8A, 8B, 8C		6	West	400	380, 750	West	Vert	pos.	2906, 2941	
	1916, 17	1B, 2B, 2C, 3B		12	Delco	87	86	Delco	2123	neg.	724	
Peerless	1914	38, 48, 60		6	G & D	C-1	K	Bosch	Mag	pos.	1302	
	1915	54, 55		4,6	G & D	T	Y	A Kent	K-2	pos.	1303	
	1915, 16	48		6	G & D	229, 241	127	A Kent	K-2	pos.	1305	
	1916	56, Ser. 1		8	G & D	252	446	A Kent	K-2	pos.	1305	
	1917	56, Ser. 2		8	Auto-L	GH	ME	A Kent	K-2	neg.	304, 341	
	1917–20	56, Ser. 3, 4, 5, 6		8	Auto-L	GH	ME	A Kent	CC	neg.	304, 341	
	1920, 21	56, Ser. 7		8	Auto-L	GH	MG	A Kent	CC	neg.	304, 341	
Pennsy	1916–19			4	Dyneto	CA	DA	Conn	GO, GA	neg.	1010	
Piedmont	1917–19	4-30		4	Dyneto	CA	DA	Delco	2118	neg.	1010	
	1917, 18	6-40		6	Remy	245D	180A	Remy	174A	neg.	2007, 2041	
	1919–21	6-40		6	Remy	230B	303A	Remy	284C	neg.	2010, 2041	
	1920, 21	4-30		4	Dyneto	CA	DA	Conn	M	neg.	1010	
Pierce-Arrow	1914	38C, 48B, 66A	Ser. 2	6	West	520	506	Bosch	Mag	pos.	2903, 2941	
	1915	38C, 48B, 66A	Ser. 3	6	West	520	501	Bosch	Mag	pos.	2903, 2941	
	1916–19	38C, 48B, 66A	Ser. 4, 5	6	West	246R	775	West,Bsh.	Hor,Mg	pos.	2905, 2941	
	1919, 20	38C, 48B	Ser. 6	6	West	781R	777	Delco	2171	pos.	2906, 2941	
	1921	Ser. 32		6	Delco	192	191	Delco	2171	pos.	729	
Pilliod	1916			4	Auto-L	GF	MC	Conn	GO	neg.	302, 341	
Pilot	1913, 14	40, 50, 60		4,6	G & D	G-1	H-1	Eise'n	Mag	two	1301	
	1915	55, 75		6	G & D	T	Y	A Kent	K2	pos.	1303	
	1916	55, 75		6	West	400	380	West	Vert	pos.	2906, 2941	*Pi*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Pilot	1916	45		6	Delco	89	86	Delco	2123, 34	neg.	724	*Pa*
(Continued)	1917–19	45		6	Delco	103	104	Delco	2139	neg.	724	
	1920	45		6	Delco	103	104	Delco	2158	neg.	724	
	1921, 22	50		6	Bijur	L-220	ED-160	Conn	M	neg.	405, 441	
Pope-Hartford	1913, 14	29, 31, 33, 35		4,6	G & D	G-1, C1	H-2	Bosch	Mag.	two	1301	
Porter	1915	45A, 45B		4	Rush	1	Rush	Bosch	Mag.	two	2151	
	1920, 21	46		4	West	765	751	Berling	Mag.	pos.	2911, 2941	
Pratt	1913	30		4	Deaco	Ign-Gen	None	Deaco		two	656	
	1913, 14	50		4	G & D	G-1	H	Bosch	Mag.	two	1301	
	1915	50		6	G & D	S	Y	A Kent	K-2	pos.	1303	
Premier	1913, 14	40, 60		6	Remy	M, MJ	Air	Eise'n	Mag.	two	2003	
	1914	48, 49		6	Remy	O	5	Eise'n	Mag.	two	2002, 2041	
	1914, 15	A		6	Remy	12A	110A	Eise'n	Mag.	two	2002, 2041	
	1915, 16	50, 51		6	Remy	165C	183A	Remy	45, 48	two	2002, 2041	
	1917	B		6	Delco	109	110	Delco	1086	neg.	724	
	1918–20	C, D		6	Delco	118	110	Delco	2145	neg.	724	
	1921	D		6	Delco	195	194	Delco	2159	neg.	726	
Premo	1921	A		6	Dyneto	CA	DA	Conn	M	neg.	1010	
Princess	1917	F		4	Disco	100	200	Dixie	Mag.	neg.	957	
Pullman	1913	36		4	N East	A-2000	M-Gen	Bosch	Mag.	two	1701	
	1914	36, 44		4	Spl'f	A-25	12-12v M-G	Bosch	Mag.	neg.	2307	
	1915, 16	24		4	Spl'f	A-25	6-12v M-G	Dixie	Mag.	neg.	2307	
	1917	424		4	Spl'f	RGU-4	SUB-4	Dixie	Mag.	neg.	2305	
	1918	424		4	Dyneto	CA	DA	A Kent		neg.	1010	
Rainier	1916			4	Spl'f	A-25	6-12v M-G	Dixie	Mag.	neg.	2307	
	1917, 18			4	Bijur	P-210	FD-140			neg.	404, 441	
Rambler	1913		Cross Country	4	U.S.L	6-12v	M-Gen	Bosch	Mag.	two	2501	
	1914		See Jeffery.									
Ranger	1920	A		6	Delco	176	177	Delco	2159	neg.	726	*Ra*

CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
R. C. H.	1915	K		4	Ward L.	RID	R-M	Bosch	Mag.	two	2801	*Rc*
Regal	1913	C, N, T		4	Rush	2	Rush	Mich'n	Mag.	two	2151	
	1914	C, CN, N, T		4	Rush	2	Rush	A Kent	K-2	two	2151	
	1915, 16	D, E		4	Dyneto	B	M-Gen	Conn	GOR	neg.	1004	
	1916, 17	F		8	Dyneto	B	M-Gen	Conn	GOR	neg.	1004	
	1917, 18	J		4	Auto-L.	GH	MF	A Kent	CC	neg.	304, 341	
Remington	1915			4	Ward L.	F	W-12	A Kent	K-2	two	2801	
Reo	1913	R-5, S-5		4	G & D	E	H-1	Nat'l	Mag.	two	1301	
	1914	R-5, S-5, S		4	Remy	OB	4A	Remy	O	two	2002, 2041	
	1915	R, S, L		4	Remy	165B	4A	Remy	45A	two	2002, 2041	
	1915	M		6	Remy	165A	181A	Remy	45A	two	2002, 2041	
	1916	N, M		6	Remy	240A	188A	Remy	45A	two	2007, 2041	
	1917, 18	M, N		6	Remy	256A	300A	Remy	284A	two	2010, 2041	
	1917, 18	R, S		4	Remy	241A	185A	Remy	45A	two	2007, 2041	
	1919	T, U		4	Remy	254A	735B	Remy	284A	two	2010, 2041	
	1920	T, U		4	Remy	920A	735C	Remy	284B	two	2010, 2041	
	1920, 21	T6, U6		6	N East	L-3711	R-3581	N East	10444	neg.	1710	
Re Vere	1919, 20	A, B, C, D		4	West	781R	775	Bosch	Mag.	pos.	2906, 2941	
	1920, 21	F		4	Bijur	K-646	AD-200	Bosch	Mag.	pos.	401, 441	
Richmond	1914	R, S, T		4,6	Jesco	5700	M-Gen	Mich'n	Mag.	two	1352	
	1915, 16		Wayne	4,6	Spl'f	A-25	12-12v M-G	Dixie	Mag.	neg.	2307	
Riddle	1917	19		6	Delco	101	102	Delco	2139	neg.	724	
	1918	19		6	Delco	101	102	Delco	2158	neg.	724	
	1919, 20	19		6	Delco	135	136	Delco	2159	neg.	724	
	1921	22		6	Delco	180	179	Delco	2159	neg.	726	
Roamer	1916	45, 54	1–13869	6	Bijur	L-61	E-68	Bosch	Mag.	two	403, 441	
	1916, 17	45, RA	13870–14004	6	Bijur	L-61	F-65	Bosch	Mag.	neg.	403, 441	
	1917–19	54	14005–	6	Bijur	L-61	ED-160	Bosch	Mag.	neg.	403, 441	
	1918	D-4-75		4	Bijur	L-61	C-8	Bosch	Mag.	neg.	404, 441	
	1919	D-4-75		4	West	760	711	Bosch	Mag.	pos.	2911, 2941	
	1920, 21	E-4-75		4	West	781-R	751	Bosch	Mag.	pos.	2906, 2941	
	1920, 21	E-6-54		6	Bijur	L-220	ED-160	Bosch	Mag.	pos.	405, 441	
Rock Falls	1918	7		6	West	760	750	West	Vert.	pos.	2911, 2941	
	1919, 20	9 to 14		6	West	400	700,751	West	SC	pos.	2911, 2941	*Ro*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Ross	1916	A, B, C		8	Detroit	AG	AM	A Kent	K-2	two	902	*Ro*
	1917, 18	C		8	Detroit	AG	AM	Conn	GA	pos.	902	
Russell	1914, 15	42, 52		4	Bijur	K-634	A-42,A-35			two	401, 441	
	1915	28		4	Bijur	K-638	A-35			two	401, 441	
	1915	32, 48		4	Bijur	K-639	A-35, A-37	Conn	G	neg.	403, 441	
R & V Knight	1919		See Moline.									
	1920, 21	R, J		4,6	Wagner	EM189A	EM322	Wagner	K-42	pos.	2703	
Saxon	1915, 16	A, B, 14		4	Detroit	RS	M-Gen	A Kent	K-2	pos.	901	
	1915	S		6	G & D	9	M-Gen	A Kent	K-2	pos.	1304	
	1916	S-2		6	Detroit	AG	AM	A Kent	K-2	pos.	902	
	1917, 18	B-5		4	Wagner	EM174	EM175	A Kent	K-3	pos.	2703	
	1917, 18	S-4		6	Wagner	EM155	EM156, 158	Remy	284B	pos.	2703	
	1919	Y-18		6	Wagner	EM343	EM167	Remy	284B	pos.	2703	
	1920, 21	125		6	Wagner	EM357	EM358	Wagner	KD286	pos.	2703	
Sayers	1918–20		Cont'l 7W Eng	6	Delco	105	106	Delco	2158	neg.	724	
	1920, 21		Cont'l 7R Eng	6	Delco	165	181	Delco	2159	neg.	726	
Scripps-Booth	1915	C		4	Leece-N	GR-500	DR-500	A Kent	K-2	two	1402	
	1915	C		4	Bijur	1213	M-Gen	A Kent	K-2	pos.	411	
	1916	C		4	Wagner	EM162	EM161	Remy	175A	neg.	2703	
	1916, 17	D, H		8	Wagner	EM169	EM168	Remy	176A	pos.	2703	
	1917, 18	G		4	Remy	248A	290B	Remy	284C	pos.	2010, 2041	
	1918, 19	6-39 to 6-42		6	Remy	234A	307A	Remy	284C	neg.	2010, 2041	
	1920	B-39 to B-42		6	Remy	234A	701A	Remy	284C	neg.	2010, 2041	
	1921	B-39 to B-42		6	Remy	911A	701A	Remy	284C	neg.	2010, 2041	
Selden	1914	49		4	G & D	C-1	K	Bosch	Mag	pos.	1302	
Seneca	1917, 18	A to G		4	A-Chal	MG	M-Gen	Remy	175A	neg.	126	
	1919, 20	H to M		4	A-Chal	MG	M-Gen	Conn	GA	neg.	126	
S. G. V	1913, 14	F		4	U.S.L	12-24v	M-Gen	Bosch	Mag	two	2501	
	1914, 15	J		4	Ward L	F	R-M	Bosch	Mag	two	2801	
Sheridan	1920, 21	B40 to B43		4	Auto-L	GH	ME	Remy	287A	neg.	304, 341	
	1921			8	Delco	220	223	Delco	2127	neg.	724	*Sh*

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Simplex	1914–16	38, 50, 75, A, D		4	Rush	2	Rush	Bosch	Mag.	two	2151	*Si*
	1914–17	46, Mod. 4, 5	Crane-Simplex to 2439	6	Rush	1	Rush	Bosch	Mag.	pos.	2151	
	1917, 18	Mod. 5	Crane Simplex 2440 and up	6	Bosch	DSG-7	DSR-3	Eise'n	Mag.	pos.	503, 2151	
Singer	1914, 15	Ser. 14, 15		6	West	203	310	Eise'n	Mag.	pos.	2902, 2941	
	1916, 17	Ser. 16, 17		6	West	203	750	Bosch	Mag.	pos.	2902, 2941	
	1918, 19	Ser. 18, 19		6	West	760	750	Bosch	Mag.	pos.	2911, 2941	
	1920, 21	Ser. 20		12	West	765	100	Philbrin		pos.	2911, 2941	
Skelton	1919, 20	35		4	West	760	100	Conn	M	pos.	2911, 2941	
	1921	35		4	West	35-AT	100	Conn	M	pos.	2911, 2941	
Spaulding	1913	G		4	G & D	E	H-1	Eise'n	Mag.	neg.	1301	
	1914, 15	H, A		4	Dyneto	B	M-Gen	Simms	Mag.	neg.	1004	
Speedwell	1913	H		4	Wagner	EM105	M-Gen	Bosch	Mag.	two	2701	
	1914, 15	I		6	West	243	380	West	Hor'l	pos.	2902, 2941	
Sphinx	1914	A		4	Spl'f	A-25	M-Gen	A Kent	H	neg.	2307	
	1915, 16	A, B		4	Spl'f	A-25	M-Gen	Conn	GO	neg.	2307	
Spoerer	1913, 14	A, C		4	Ester	DB, DC		Bosch	Mag.	two	1102	
	1914	40		4	G & D	C-1	K	Bosch	Mag.	pos.	1302	
Standard	1915			6	West	203	310	Bosch	Mag.	pos.	2902, 2941	
	1915			8	West	207	310	West	Vert.	pos.	2902, 2941	
	1916	E		8	West	208	700	West	Vert.	pos.	2902, 2941	
	1917	F		8	Spl'f	GU-6	RSUB-3	Dixie	Mag.	pos.	2305	
	1918	G		8	West	400	700	Dixie	Mag.	pos.	2906, 2941	
	1919–21	H, I		8	West	760	751	Dixie, A Kt	Mag,CC	pos.	2911, 2941	
Stanley	1919–21	735	Steamer	2	Remy	239A	None	None		neg.	2010	
States	1916	C		6	Dyneto	VA	UA	Conn	GO	two	1008	
Staver	1914	45, 65		4,6	Ester	D-C	A-Chal	Simms	Mag.	two	1102	
Stearns	1913	Six		6	G & D	G-1	H-1	Mea	Mag.	two	1301	
	1914	K-4, K-6		4,6	G & D	C-1	K	Bosch	Mag.	pos.	1302	
	1915	K-4, K-6, L-4		4,6	G & D	T	Y	Bosch	Mag.	pos.	1303	*St*

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CAR	Years	MODELS	Serial Numbers, Engine or Identification	Cylinders	Starting and Lighting System	Generator or Motor-Generator	Starting Motor	Ignition System	Coil Type	Ground or 2-Wire	Sections	
Stearns	1916, 17	SK-L4		4	West	208	755	Remy	175	pos.	2902, 2941	*St*
(Continued)	1916–18	SK-8		8	West	208	750	Remy	176	pos.	2902, 2941	
	1918	SK-L4		4	Remy	252A	296A	Remy	175A	pos.	2008, 2041	
	1919	SK-L4		4	Remy	238A	309A	Remy	285B	pos.	2012, 2041	
	1920, 21	SK-L4		4	West	765	755	A Kent	CC	pos.	2911, 2941	
Stephens	1916	65		6	Auto-L	GG	ME	Conn	GO	neg.	303, 341	
	1916, 17	60, 65		6	Delco	105	106	Delco	2139	neg.	724	
	1918, 19	70 to 78		6	Delco	123	100	Delco	2161	neg.	724	
	1920, 21	82 to 86, Ser. 1 to 4		6	Auto-L	GJ	MC	Conn	GA	pos.	305, 341	
Sterling	1915			4	Auto-L	GB	MF	Conn	GO	neg.	303, 341	
Stevens-Duryea	1914	C		6	West	201	Air	Bosch	Mag	pos.	2902	
	1915	D		6	Delco	35	M-Gen	Bosch	Mag,Bat	pos.	704	
	1920, 21	E		6	West	781R	777	Berling	Mag	pos.	2906, 2941	
Stewart	1915			6	West	246R	315	West	Hor'l	pos.	2905, 2941	
	1916	T		6	West	450	318	West	Vert	pos.	2911, 2941	
Studebaker	1913	35, Six		4,6	Wagner	EM101	M-Gen	Spl'f	Mag	two	2701	
	1914	SC, EB		4,6	Wagner	EM107	EM106	Remy	O	two	2702	
	1915	SD, EC		4,6	Wagner	EM114	EM113	Remy	O	two	2702	
	1916	SF, ED		4,6	Wagner	EM126	EM117	Remy	171	pos.	2703	
	1917	SF, ED	Ser. 18	4,6	Wagner	EM126	EM154	Remy	171	pos.	2703	
	1918, 19	SH, LH, EG, EH	Ser. 19	4,6	Wagner	EM214	EM183, 201	Remy	284D	pos.	2703	
	1920, 21	EG, EH		6	Wagner	EM355	EM356	Wagner	K-43	pos.	2703	
	1920, 21	EJ		6	Wagner	EM326, 338	EM201	Wagner	K-43	pos.	2703	
	1920, 21	EJ		6	Remy	917A	715B	Remy	284A	pos.	2010, 2041	
	1921	EG, EH		6	Remy	917E	736A	Remy	284D	pos.	2010, 2041	
Stutz	1914	E		4,6	Remy	O	5A	Spl'f	Mag	two	2002, 2041	
	1915	F		4	Remy	O	5B	Bosch	Mag	two	2002, 2041	
	1915	F		6	Remy	O	5B	Eise'n	Mag	two	2002, 2041	
	1915	H. C. S		4	Remy	O	126A	Remy	O	two	2002, 2041	
	1916, 17	C, R		4,6	Remy	OD	189A	Bosch	Mag	two	2002, 2041	
	1918–20	S, G, H		4	Remy	OD	189A, 291A	Delco	2159,62	two	2002, 2041	
	1921	K		4	Remy	OF	741A	Delco	2162	pos.	2002, 2041	*St*

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Sun	1916, 17	17		6	Remy	166B	180B	Remy	172A	neg.	2007, 2041
	1918	18		6	Auto-L	GH	ME	Conn	GA	neg.	304, 341
Templar	1917, 18	445		4	Remy	234B	305C	Remy	284B	pos.	2010, 2041
	1919	A-445		4	Bijur	L-61	ED-160	Simms	Mag.	pos.	404, 441
	1920, 21	A-445		4	Bijur	L-220	ED-160	Simms	Mag.	pos.	405, 441
Texan	1918	H		4	Auto-L	GH	ME	Delco	2138	neg.	304, 341
	1919	A38, B38		4	Dyneto	CA	DA	Delco	2138	neg.	1010
	1919, 20	A38, B38		4	Bijur	L-61	FD-140	Eise'n	Mag.	neg.	404, 441
	1920	A38, B38		4	Bijur	P-230	FD-140	Conn	M	neg.	405, 441
	1921	E		4	Bijur	L-220	ED-160	Conn	M	neg.	405, 441
Touraine	1914			6	G & D	C-1	K	Bosch	Mag.	pos.	1302
	1915			6	West	240	310	Simms	Mag.	pos.	2902, 2941
Trumbull	1915, 16	A, B		4	Ward L	RM	KD	Dixie	Mag.	pos.	2801
Tulsa	1918	T		4	Dyneto	CA	DA	Delco	2138	neg.	1010
	1919, 20	D		4	Dyneto	CA	DA	Conn	GO, GA	neg.	1010
	1920, 21	E		4	Dyneto	CA	DA	Conn	M	neg.	1010
Velie	1913, 14	5		4	G & D	G-1	H-1	Bosch	Mag.	two	1301
	1913, 14	9, 40		4	G & D	E	H-2	Bosch	Mag.	two	1301
	1914	10		6	G & D	C-1	K	A Kent	K-2	pos.	1302
	1915	11, 12		4	G & D	T	Y	Bosch	Mag.	pos.	1303
	1915	14, 15	Biltwell	6	G & D	T	Y-1	A Kent	K-2	pos.	1303
	1916	15		6	G & D	227	133, 137	A Kent	K-2	pos.	1305
	1916, 17	22, 28		6	Remy	161A	180A	Remy	172A	pos.	2007, 2041
	1916, 17	27		6	Remy	243A,243B	293A	Remy	172A	pos.	2007, 2041
	1918	28, 38		6	Remy	161C,161D	180A	Remy	175C	pos.	2007, 2041
	1919	38, 48A		6	Remy	230A	303A	Remy	284B	pos.	2010, 2041
	1918, 19	39		6	Remy	231A,231B	299B,303C	Remy	284B,284C	pos.	2010, 2041
	1919	48		6	Bijur	L-61	ED-160	A Kent	CC	pos.	404, 441
	1920, 21	48		6	Bijur	L-220	ED-160	A Kent	CC	pos.	405, 441
	1920, 21	34		6	West	150	151	A Kent	CC	pos.	2911, 2941
Vulcan	1914, 15	27, 35		4	West	230	300	West	Hor'l	pos.	2902, 2941
Warren	1913	R		6	N East	A-2000	M-Gen	Bosch	Mag.	two	1701

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Westcott	1913	40, 50		4,6	Electro	Ign-Gen	M-Gen	Electro		two	1075	
	1914	O-30		4	Jesco	7-NU	M-Gen	A Kent	K-2	pos.	1353	
	1915	O-35		4	Delco	64	M-Gen	Delco	2111	neg.	710	
	1915	U-50		6	Delco	59	M-Gen	Delco	2111	neg.	710	
	1916	41, 42		6	Delco	83, 93	M-Gen	Delco	2121	neg.	715	
	1916	51		6	Delco	73	M-Gen	Delco	2121	neg.	715	
	1917	Ser. 17		6	Delco	101	102	Delco	2139	neg.	724	
	1918	Ser. 18		6	Delco	101	102	Delco	2158	neg.	724	
	1918, 19	Ser. 18A, A-48		6	Delco	135	136	Delco	2159	neg.	724	
	1919	A-38		6	Delco	105	106	Delco	2158	neg.	724	
	1920	B-38		6	Delco	165	164	Delco	2159	neg.	726	
	1920, 21	B-48, C-48		6	Delco	180	179	Delco	2159	neg.	726	
	1920, 21	C-38		6	Delco	165	181	Delco	2159	neg.	726	
White	1913	GAE, GEB, GF		4,6	Dyneto	Entz	M-Gen	Mea	Mag	two	1001	
	1914–16	GA, GE, GF		4,6	Dyneto	Entz	M-Gen	Bosch	Mag	two	1001	
	1917, 18	GM	16-Valve	4	Leece-N	G113	391M	Eise'n	Mag	two	1404, 1441	
Wills Ste. Claire	1921, 22	A		8	Delco	207	M-Gen	Delco	2159	neg.	731	
Willys Six	1917, 18	89	See Overland also	6	Auto-L	GA	MD	Conn	GA	neg.	302, 341	
Willys-Knight	1914, 15	K-17, K-19		4	U.S.L	12-24v	M-Gen	Simms	Mag	two	2503	
	1916–19	84, 88-4		4	Auto-L	GF	MC	Conn	GA	neg.	302, 341	
	1917. 18	88-8		8	Auto-L	GG	MC	Remy	175	neg.	303, 341	
	1920, 21	20		4	Auto-L	GJ	MH	Conn	M	neg.	305, 341	
Winther	1920, 21	61		6	West	760	100	West	SC	pos.	2911, 2941	
Winton	1913, 14	20		6	G & D	E	H-1	Bosch	Mag	pos.	1301	
	1914, 15	21		6	Leece-N	C-400	W-300	Bosch	Mag	two	1404	
	1914, 15	21		6	Bijur	K-628,638	A-42	Bosch	Mag	pos.	401, 441	
	1915, 16	21A, 22		6	Bijur	K-634	A-14	Bosch	Mag	pos.	401, 441	
	1915	21A		6	Bijur	K-643	C-3	Bosch	Mag	pos.	401, 441	
	1916–21	22A, 33, 24, 25		6	Bijur	K-643	C-8	Bosch	Mag	pos.	401, 441	
	1917, 18	48		6	Bijur	K-634	A-42	Bosch	Mag	pos.	401, 441	
Yale	1917, 18	M		6	Dyneto	CA	DA	Remy	175	neg.	1010	
Zimmerman	1913	Z-6		6	Deaco	Ign-Gen	None	Deaco		two	656	*Zi*

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ADJUSTING THIRD BRUSH GENERATORS

Many generators have been damaged after leaving the service stations, due to the third brush setting having been made with a partially discharged battery. As an example of the harm that may be done with such a setting, consider the following:

On a certain make of third brush generator, the output against various voltages of the battery is—

Battery voltage....7.5.....gives output of 16.0 amperes.
Battery voltage....7.0.....gives output of 14.0 amperes.
Battery voltage....6.5.....gives output of 12.0 amperes.

Therefore, if the setting (normal) of 16.0 amperes is made with a low battery having a voltage of 6.5 and requiring a setting of only 12.0 amperes, the excessive rate when the battery becomes charged will seriously damage the equipment.

Do not make any third brush settings against a low battery. If the car's battery does not show at least 1.260 Sp. Gr. or more, either have it charged or else make the setting against one of your own fully charged batteries, after which the car's battery can be replaced and the charge rate against this low battery disregarded.

———

Do not make changes in the third brush setting until commutator, brushes, fields and armature have been examined and found in good order.

Always connect a testing ammeter in the charging circuit (as given under **"Generator, Test Terminals,"** on Test Data sheets) while changing the setting of the third brush. If the brush is not sanded in after making a change the charge rate will increase after the car is driven for a short time.

Unless the instructions in the Test Data sheets mention otherwise, do not make a third brush setting with a cold generator. Run it under nearly full load for ten to twenty minutes, or until it feels quite warm to the hand.

———

In order to get an approximate idea of what effect will be secured by moving the third brush, lift the brush from the commutator and with a piece of stranded copper wire attached to the brush or brush holder, touch the commutator at several points near the third brush position, noting the change in output secured at each connection. On a strange generator this will give a valuable indication of what can be, or cannot be, accomplished before the third brush is loosened for adjustment.

———

Make third brush settings in accordance with individual driving conditions for the particular car being handled. Be sure that all wiring and the general condition of generator and battery are good. Make a trial setting, within the limits given by the Test Data sheets, and instruct the owner to return in one week. Then test the battery gravity and compare the readings with those secured at the time of setting. If the gravity is too high, lower the charge rate; if it is too low and still dropping, raise the rate.

CUT-OUT ADJUSTMENTS

In adjusting magnetic cut-outs keep the following points in mind:

Do not adjust a cut-out with a discharged battery in circuit or with a cold generator. If necessary, use one of your own fully charged batteries for making the setting. Run the generator until it feels quite warm.

Spring tension adjustment will primarily affect the opening and to a less degree will affect the closing.

Increase spring tension to make the opening with smaller discharge.

Decrease the spring tension if the cut-out opens while generator is still charging.

Adjustment of gap between armeture and magnet end (with contacts closed) should be made so that there is no possibility of the armature metal making contact with the magnet core metal, otherwise the cut-out can not be made to open properly.

Adjustment of gap between armature and magnet end (with contacts open) will primarily affect the closing and to a less degree will affect the opening.

Increase of armature gap will raise the voltage and speed of cut-out closing.;

Lessening of the armature gap will lower the voltage and speed of closing.

In making cut-out adjustments connect a voltmeter across the generator (see **"Test Terminals"** under Generator division of Test Data sheets) and place a zero center testing ammeter in the charging circuit or attach it directly to the cut-out between the main terminal leading to the battery and the wire removed. See Diagram 73.

First adjust the armature gap so that the cut-out closes at the correct voltage as given on the Test Data sheet. The speed should correspond but if the speed is too high with the voltage correct, it indicates trouble in the generator and not in the cut-out.

Next adjust the spring tension to make the cut-out open with a discharge no greater than the highest value given on the Test Data sheet. Endeavor to get an opening as near zero discharge as possible without affecting the closing too much. Increasing the spring tension too much in trying to secure a zero opening will probably make the closing come at too high a voltage.

Finally test the closing again. Correct closing is of more importance (from the battery standpoint) than correct opening. However, the opening should be kept within the limits given.

Do not under-estimate the value of cut-out adjustment in keeping the battery fully charged.

STARTING MOTOR PERFORMANCE

In testing a motor, remember that lock torque and running free readings are generally of more importance than running torque values.

When the brake pressure is brought down hard enough to get the lock torque reading, read the ammeter and voltmeter instantly and release the brake at once, for the sake of both battery and motor.

The battery voltage is important in testing a starting motor. With a discharged battery all readings will be valueless. Therefore, always use a fully charged battery and use one of the greatest capacity (in ampere-hours) that is available.

In order to secure the voltage given on the Test Data sheets, we suggest connecting a variable resistance in parallel with the testing battery, then using this resistance to get the specified voltage while taking the readings of amperage and torque. Connections should be made as shown in Diagram 91.

ADLAKE

VOLTAGE: 6.

CHARGE RATE: With button in upper left corner of controller pushed in—5 amperes maximum with no lamps on or with side and tail lamps only.

10 amperes maximum with head lamps on.

With button in upper left corner of controller pulled out—10 amperes maximum regardless of lamp load.

GENERATOR: Shunt wound, two-pole machine; with two field coils and two brushes.

Test Terminals: Ammeter between terminal —D and wire removed. Voltmeter between terminals —D and +D.

Field Terminals: —D to +F for shunt field.

CONTROLLER: Contains field rheostat at top; charge-rate switch in upper left-hand corner; solenoid and shot-filled plunger below rheostat arm; head-lamp switch under rheostat at right; cut-out under head-lamp switch in lower right corner.

Two fuses in lower left corner; upper being 10-ampere open link in charging circuit, lower being 5-ampere open link in field circuit.

REGULATION: Rheostat in upper part of controller in series with generator shunt field. Moving arm, balanced by plunger, with end of arm carrying brush which cuts in more or less resistance. With generator idle, arm is at bottom of travel. At 450 R. P. M. of generator, arm starts to move upward, inserting field resistance. Plunger is pulled downward by action of solenoid magnet coil through which the charging current passes; increase of charge current causing increased pull on the plunger and raising the rheostat arm.

Maximum output rate may be changed by taking cover off plunger and removing bird shot to decrease the output, adding bird shot to increase the rate. The rate may be increased to 15 amperes without damage to the dynamo.

Small push-and-pull switch in upper left-hand corner of controller may be pulled out to cause the generator to give 10 amperes output regardless of lamps turned on, this having the same effect as closing the head-lamp switch.

Keep rheostat segments wiped clean with gasoline moistened brush or cloth. Keep only light pressure on brush in rheostat arm.

If starter is used, keep small switch in upper left corner of controller pulled out at all times.

Sticking rheostat arm will cause 10-ampere fuse to blow.

Sticking cut-out or loose connection in charging circuit will cause 5-ampere field fuse to blow.

CUT-OUT: Magnetic, in lower right-hand corner of controller. Four coils.

With contacts open the gap between the contacts should be $\frac{1}{16}''$. With contacts closed the gap between the magnet ends should be $\frac{1}{64}''$.

Closes at 7.25 to 7.75 volts and opens with 1.0 to 1.5 ampere discharge.

DIAGRAM: See Diagram 111.

ALLIS-CHALMERS

MOTOR-GENERATOR, CONSTANT CURRENT REGULATION.

VOLTAGE: 6

CHARGE RATE: 10 to 15 amperes at generator speeds above 1500-1800 R. P. M.; the rate depending on the setting of the regulator and on the requirements of the car to which fitted. The usual rate is between 10 and 12 amperes.

MOTOR-GENERATOR: Shunt and series wound, four field coils, two windings on each pole. Four brushes, two positive and two negative.

Test Terminals: Ammeter between terminal A and wire removed, selecting the smaller of the two wires attached at this terminal, this small wire leading to terminal D+ on the regulator unit. Voltmeter between terminal A and terminal "Se" which is usually grounded; or between terminal A and any ground.

Field Terminals: Shunt field between terminal "Sh" and negative brush rig. Series field between terminal "Se" and negative brush rig.

REGULATION: Constant amperage maintained by Briggs and Stratton combined regulator and cut-out. The regulator for the early models is a separate unit, for the later models it is mounted in the dash panel with the fuses, ammeter, and lighting switch.

Output rate is increased by bending the regulator spring support to increase the spring tension; it is decreased by bending the spring support to decrease the spring tension. The regulator contacts are the pair found closed with the generator idle. The cover of the regulating unit is sealed.

CUT-OUT: Magnetic, combined with current regulator in single unit, as described under **Regulation** above.

Closes at 7.5 to 8.0 volts; 1100-1200 R. P. M.; opens with discharge of 0.0 to 1.5 amperes.

Adjust closing point by means of magnet air gap. Adjust opening by bending spring support to alter tension of spring.

DASH UNIT: Early Models: Having regulator and cut-out in cylindrical housing with outside resistance coil and single fuse on cover; contains regulator and cut-out combined in single unit. Cut-out points between terminals D+ and B+, or between terminal B+ and fuse clip nearest center of cover. Regulator contacts between terminal F and fuse clip nearest center of cover. One cartridge fuse of 45-ampere capacity in charging circuit and mounted on cover of controller unit.

Later Models: Combined regulator and cut-out carried in dash panel together with lighting switch, polarity switch, and ammeter. There are two fuses in this panel; one of 45-ampere capacity carrying the charging current and the shunt field current, the other of 20-ampere capacity in the light and horn circuits. The poplarity (ignition) switch reverses the direction of currnet flow across the breaker contacts each time the switch is turned off and on. Cut-out points between terminal DYN+ and ammeter wire. Regulator contacts between terminal DYN+ and terminal FIELD.

STARTING SWITCH: Single pole, single contact, with auxiliary contacts which open the charging circuit between the positive terminal of the battery and the B— terminal of the separate regulator or the "INTERLOCK" terminal of the dash panel; this circuit being opened whenever the starting switch is closed.

DIAGRAMS: For early models with regulator-cut-out in cylindrical housing see Diagram 156.

For later models with dash panel see Diagram 157.

ATWATER KENT

SHUNT WOUND GENERATOR, THIRD BRUSH REGULATION.

VOLTAGE: 6.

CHARGE RATE: Higher rates are secured with cold generator, lower values with hot generator. Fully charged battery will give slightly higher rate than discharged battery.

Speed	
550 R. P. M.	3.0- 4.0 amps, 6.5 volts, cuts in.
600 R. P. M.	5.0- 6.0 amps, 6.6 volts,
800 R. P. M.	10.0-11.5 amps, 7.3 volts
1000 R. P. M.	12.0-14.3 amps, 7.7 volts
1200 R. P. M.	12.5-15.0 amps, 7.8 volts
2000 R. P. M.	9.6-11.6 amps, 7.6 volts

GENERATOR: Four-pole shunt wound machine with four field coils.

Two main brushes set at 90 degrees from each other on lower part of commutator. Third brush on upper part of commutator and toward right.

Test Terminals: Ammeter between terminal on cut-out and outside wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field winding between third brush and negative main brush.

REGULATION: Third brush controls field current and output. Third brush on upper side of commutator. Moving this brush to the right, clockwise, increases the charge rate, moving it to the left lowers the rate.

The third brush holder is held by a stud and lock nut. With the nut loosened, the brush may be moved either way.

CUT-OUT: Magnetic, mounted on top of generator.

Closes at 550 R. P. M., 6.5-7.0 volts, 3.0-4.0 amperes.

Opens with discharge of 0.0-2.0 amperes.

The series winding is between the positive brush and the stationary contact with the movable contact grounded. The shunt winding is between the terminal on the cut-out and the lead from the positive brush to cut-out.

STARTER: Four-pole series wound motor with four brushes and four field coils. All four coils are attached to the motor terminal. The two positive brushes are joined together and the two negatives are joined together. The inner ends of all four field coils are joined to the positive brushes. The negative brushes are grounded.

Speed	Ft-Lbs Torque	Amperes	Volts
Locked	14.0	570	3.5
400 R. P. M.	10.5	450	4.0
800 R. P. M.	6.9	320	4.6
1200 R. P. M.	4.1	230	5.0
2000 R. P. M.	1.6	130	5.5
3000 R. P. M.	0.7	80	5.7

DIAGRAMS: See Diagram 251.

AUTO-LITE

PERMANENT MAGNET GENERATOR

MODEL: C-60.

VOLTAGE: 6.

CHARGE RATE: Due to constant speed and voltage, the charge rate depends on the condition of the battery charge. With fully charged battery, the maximum rate will be 13 amperes, as given below. With discharged battery, the maximum rate will be 17 amperes.

Rates with charged battery (1.250-1.300 Sp. Gr.)

600 R. P. M.	1.2 amperes, cuts in
1000 R. P. M.	7.5 amperes
1250 R. P. M.	10.0 amperes
1500 R. P. M.	12.0 amperes
1800 R. P. M.	13.0 amperes, governor slips

GENERATOR: Two-pole machine with permanent magnet field composed of three sets of three magnets each. Two brushes on opposite sides of commutator; positive at right, negative at left.

Test Terminals: Ammeter between either terminal and wire removed. Voltmeter between two terminals on commutator end of generator.

REGULATION: Constant speed maintained above 1800-1850 R. P. M. by slipping-clutch centrifugal governor. Two weights are carried on two arms and attached to two friction shoes driving the armature shaft. The weights are inside a drum driven from the engine.

The charge rate is increased by loosening the screws that hold the weights and moving the weights inward on their arms, closer to the pivoted ends of the arms. The weights should be moved equal distances and should stand at corresponding points on their arms when finally locked.

The governor shoes and inside of the drum should be wiped clean with a gasoline soaked cloth before assuming that the position needs adjustment. If the battery gravity is below 1.250, it should be charged before making the adjustment.

CUT-OUT: Magnetic, carried under arch of magnets and above armature. Consists of two coils, each containing shunt and series windings.

Closes at 7.0-7.5 volts, 600 R. P. M., 0.5-1.0 ampere.

Opens with discharge of 1.0-2.0 amperes.

Spring tension adjusted by bending support for end of spring toward drive end.

Cut-out arm carries two pairs of contacts; one pair (charging) open while the generator is idle, and the other pair (shunt winding) closed while the generator is idle. The closed pair carries current for the shunt winding of the cut-out and as the main contacts are closed by the magnet, this shunt winding pair is opened. The current through the series winding then holds the cut-out closed.

STARTER: See section 341 on Auto-Lite Starting Motors.

DIAGRAM: See Diagram 351.

AUTO-LITE

SINGLE COIL, REVERSED SERIES GENERATORS

MODELS: G, GA, GF.

VOLTAGE: 6.

CHARGE RATES: Slightly lower rates will be secured with a hot generator.

	Model G	Model GA—GF Engine Speed	Model GA 1½ Engine Speed
Cut-in, R. P. M.	250	300	375
Cut-in, amperes	3.0	1.7	2.0
400 R. P. M.	6.0	4.3	2.6
700 R. P. M.	8.5	9.5	7.8
1000 R. P. M.	10.0	12.2	10.7
1500 R. P. M.	11.5	15.1	14.2
2000 R. P. M.	11.7	16.2	16.0

GENERATOR: Two-pole machine, horse-shoe field frame with single coil above armature. Coil contains shunt and reversed series windings.

Two brushes at opposite sides of commutator, positive on left, negative on right.

Test Terminals: Ammeter between either generator terminal and wire removed. Voltmeter between two generator terminals on field coil housing.

Motoring Current: 2.0-2.5 amperes, 6.3 volts, 275 R. P. M.

Field Terminals: Shunt field between positive and negative terminals; series field between positive brush and positive terminal on G, GF, and GA engine speed. On GA 1½ engine speed, the shunt is between the positive and negative terminals, the series between the negative brush and negative terminal.

Field Current: 1.0 ampere at 6.0-6.3 volts.

REGULATION: Reversed series field winding opposing shunt field. No adjustment provided.

CUT-OUT: Magnetic, mounted as separate unit.

Closes at 6.5-7.0 volts; speed and amperage given under **Charge Rates.**

Opens with discharge of 0.5-1.5 amperes.

The armature gap is adjusted by the nut and stud passing through the armature near the pivoted end. The spring tension is adjusted by bending the leaf spring under the armature with a pair of flat-nosed pliers.

There are two pairs of contacts, one pair carbon (outside) and the other copper (inside). The carbon contacts should be set to close first and open last so that they will take any spark occurring when the cut-out opens.

See Drawings 377 and 378.

STARTER: See Section 341 on Auto-Lite Starting Motors.

DIAGRAMS: See Diagrams 353 and 354.

AUTO-LITE

SQUARE FRAME GENERATORS, REVERSED SERIES REGULATION

MODELS: GB, GC, GD and GG.

VOLTAGE: 6.

CHARGE RATES: Slightly lower rates will be secured with a hot generator.

	GB	GC	GD	GG
Cut-in, R. P. M.	350	300	600	550
Cut-in, amps	1.0 amp	1.5 amp	1.5 amp	1.5
400 R. P. M.	2.7 amp	4.5 amp		
500 R. P. M.	5.0 amp	6.4 amp		
700 R. P. M.	8.0 amp	9.2 amp	3.7 amp	4.6
1000 R. P. M.	10.8 amp	11.6 amp	7.7 amp	8.3
1500 R. P. M.	13.1 amp	13.7 amp	10.7 amp	11.4
2000 R. P. M.	14.2 amp	14.7 amp	11.7 amp	12.5

GENERATOR: Model GB: Two-pole machine, two field coils, one above and one below armature. Two brushes on opposite sides of commutator. Two terminals on side of housing.

Models GC and GD: Four-pole machines, two field coils, one above and one below armature. Two consequent poles. Two brushes set at 90 degrees from each other on one side of commutator above and below center line. Two terminals on side of housing.

Model GG: Two-pole machine, two field coils, one above and one below armature. Two brushes on opposite sides of commutator. Two terminals on top of housing.

Each field coil contains both shunt and reversed series field windings.

Test Terminals: Ammeter between positive (ungrounded) terminal and wire removed. Voltmeter between this terminal and other terminal on housing.

Motoring Current: 3.0-3.5 amperes, 6.0-6.3 volts, 600-750 R. P. M.

Field Terminals: One half series winding between each brush and corresponding terminal (top or bottom, left or right). Shunt field winding, two coils in series between two brushes.

Field Current: 1.0-1.4 amperes at 6.0-6.3 volts.

REGULATION: Reversed series field windings oppose shunt fields to limit output. No adjustment provided.

CUT-OUT: Magnetic, mounted as separate unit.

Closes at 6.0-7.0 volts; speed and amperage given under **Charge Rates**.

Opens with discharge of 1.0-2.0 amperes.

The cut-out having both carbon and copper contacts is the same as that described in the preceding Section 302, which see.

On the single contact cut-out, the armature gap is adjusted by bending the armature stop. The spring tension is adjusted by bending the spring with flat-nosed pliers.

See Drawings 378 and 379.

STARTER: See Section 341 on Auto-Lite Starting Motors.

DIAGRAMS: See Drawings 355, 356 and 360.

AUTO-LITE

SQUARE FRAME, THIRD BRUSH GENERATORS

MODEL: GH.

VOLTAGE: 6.

CHARGE RATES: Higher rates secured with cold generator or fully charged battery. Lower rates secured with hot generator or discharged battery.

600 R. P. M., cuts in	1.0- 2.0 amperes
900 R. P. M.	6.8- 8.6 amperes
1200 R. P. M.	11.0-13.0 amperes
1500 R. P. M.	13.9-15.6 amperes
1800 R. P. M., maximum	15.0-16.5 amperes
2500 R. P. M.	13.0-14.6 amperes

GENERATOR: Two-pole shunt wound machine with two field coils, one above armature and one below.

Two main brushes at opposite points of commutator with third brush above either right-hand or left-hand main brush, depending on direction of rotation.

Test Terminals: Ammeter between positive terminal and wire removed. Voltmeter between two terminals (positive and negative) or between positive terminal and ground.

Motoring Current: 2.5-3.5 amperes, 6.0-6.3 volts, 400-500 R. P. M.

Field Terminals: Shunt field coils in series between third brush and opposite main brush lead or terminal post for opposite main brush.

Field Current: 2.0-2.4 amperes, 6.0-6.3 volts.

REGULATION: Third brush controls field current and output. Moving this brush with direction of armature rotation (closer to nearest main brush) increases charge rate; moving it against rotation lowers the rate.

The third brush holder is held in a segment slot in the brush-holder plate. After loosening the stud, the third brush may be moved in either direction.

CUT-OUT: Magnetic, mounted as separate unit or on top of generator.

Closes at 7.0-8.0 volts, 600-650 R. P. M., 1.0-2.0 amperes.

Opens with discharge of 0.0-2.0 amperes.

The armature gap is adjusted by bending the armature stop arm.

The spring tension is adjusted by bending the finger attached to the body of the armature and holding the free end of the leaf spring attached to the cut-out body.

Contacts and series winding between two outside terminals.

See Diagram 380.

STARTER: See Section 341 on Auto-Lite Starting Motors.

DIAGRAMS: See Diagrams 357 and 359.

AUTO-LITE

ROUND FRAME, THIRD BRUSH GENERATORS

MODELS: GJ and GK.

VOLTAGE: 6.

CHARGE RATES: Higher rates secured with cold generator or fully charged battery. Lower rates secured with hot generator or discharged battery. Exact rate depends on setting of third brush according to car and service conditions. Following are usual limits:

550 R. P. M., cuts in	2.0- 3.0 amperes
750 R. P. M.	6.8- 8.5 amperes
1000 R. P. M.	11.0-13.0 amperes
1250 R. P. M.	13.4-16.0 amperes
1500 R. P. M., maximum	13.8-17.0 amperes
2000 R. P. M.	11.0-14.0 amperes

GENERATOR: Four-pole, shunt wound machine with four field coils.

Two main brushes at 90 degrees from each other and third brush on opposite side of commutator. Negative brush grounded.

Test Terminals: Ammeter between generator terminal and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field coils in series between third brush and grounded main (negative) brush.

REGULATION: Third brush controls field current and charge rate. Moving this brush with direction of armature rotation increases the charge rate; moving it against rotation lowers the charge rate.

The third brush holder is held in a segment slot in the brush-holder plate. After loosening the holder stud, the third brush may be moved in either direction.

CUT-OUT: Magnetic, mounted as separate unit or on top of generator.

Closes at 6.5-7.5 volts, 550-600 R. P. M., 1.0-2.0 amperes.

Opens with discharge of 0.0-2.0 amperes.

Adjustment same as for preceding Section 304, Drawing 380.

STARTER: See Section 341 on Auto-Lite Starting Motors.

DIAGRAMS: See Diagrams 373 and 375.

AUTO-LITE

STARTING MOTORS

MODELS: M,MC, MD, ME, MF, MG, MH.

VOLTAGE: 6.

PERFORMANCE:

Ft.-Lbs. Torque	Model M			Models ME and MF		
	Amperes	R. P. M.	Volts	Amperes	R. P. M.	Volts
2	150	2500	5.5	120	1450	5.6
4	260	1575	5.0	190	950	5.2
6	375	1000	4.6	265	610	4.8
8	500	580	4.2	330	355	4.4
10	630	280	3.7	390	160	4.0
12	800	40	3.2	460	50	3.6
	Models MC, MD			Models MG, MH		
2	140	1800	5.6	100	1060	5.8
6	290	1000	5.0	230	650	5.3
10	460	495	4.4	360	375	4.7
14	650	125	3.8	485	140	4.1
16	750	lock	3.4	560	50	3.8
18				620	lock	3.4

CIRCUITS: Two-terminal machines (M, MC, MD, ME, MF), opposite brushes are joined, two and two. Two field coils are in series between one terminal and one pair of brushes, the other two coils in series between the other terminal and the other pair of brushes. Model M uses two field coils and two consequent poles.

Single-terminal machines (MG, MH) have two opposite brushes grounded, the other two being joined together. The four field coils are in two series pairs, each pair connected between the terminal and the connection between the two ungrounded brushes.

SWITCHES: In addition to the regular single contact switches, two special types have been used.

With some Model M motors a sliding-contact switch is carried on or near the motor and operated by an interconnection with the pinion-shifting rod. The switch rod carries a spring, so that should the pinion and flywheel teeth butt together, the switch is closed, after which the pinion is snapped into mesh by the spring.

With some Model MC motors the switch is attached to the starting motor and includes a movable contact carried by the rod that shifts the pinion. The rod can only be moved after a detent plunger has been withdrawn by the action of a solenoid which is magnetized when a switch button on the steering column is pressed.

DIAGRAMS: See Diagrams 352, 371, 374 and 376.

BIJUR

CONSTANT VOLTAGE SYSTEMS

TYPES: External Controller—H-62, H-67, K-634, K-638, K-643, K-646. Internal Controller—K-620, K-628.

VOLTAGE: 6 (12 in a few cases).

CHARGE RATE: On the name plate and following the abbreviation "Mfg. Inf." are letters and numbers, such as "R-75-B". The last letter, as B in this case, indicates the correct voltage setting.

The settings are as follows:

A	7.5 volts	D	8.1 volts
B	7.75 volts	E	8.0 volts
C	7.85 volts	F	14.8 volts

In the absence of letters, use the following—

6-volt machines	1000-1400 R. P. M	7.75-8.0 volts
12-volt machines	1300-1500 R. P. M.	5.5 amperes

The charge rate depends on the voltage and charge of the battery. With a discharged battery (low voltage) the rate will be high; while it will be low with a charged battery. Starting with a discharged battery the rates will be approximately as follows at speeds of 800-2000 R. P. M. on a 6-volt system.

1.150 Sp. Gr	16.0 amps.	1.250 Sp. Gr	6.0 amps.
1.175 Sp. Gr	12.5 amps.	1.275 Sp. Gr	5.3 amps.
1.200 Sp. Gr	9.7 amps.	1.300 Sp. Gr	4.7 amps.
1.225 Sp. Gr	7.5 amps.		

GENERATOR: Four-pole, shunt wound machine, with four field coils.

Two brushes set at 90 degrees from each other and on upper side of commutator.

Test Terminals: Ammeter between generator pin hole 1 and pin 1 on external regulator box; or in line from disconnect plug with either location of regulator. Voltmeter between posts 1 and 3, or between the two lines leading away from the disconnect plug on either type of machine.

Field Terminals: Shunt field between posts 2 and 3.

Motoring Current: 2.5-3.0 amps., 6.0 volts, 300-400 R. P. M.

Field Current: 1.5 amps., 6.0 volts.

REGULATION: Constant voltage maintained by a vibrating type of regulator controlling resistance in the shunt field circuit. The regulator (together with the cut-out) may be mounted in an aluminum box on the top of the generator or inside the generator housing. The demountable outside controller carries three split pins which fit into three holes on the generator and is held in place by a screw passing through it.

At one end of the controller box when outside the generator, or on the generator with the internal controller, there is a socket into which fits a plug carrying two contacts that meet two spring plungers in the socket. The plug carries the wire or wires for outside circuits. Once in each 500 miles of driving this plug should be reversed (to reverse current through regulator) by pushing it in as far as it will go, then turning it past its vertical position until it springs out and locks in the opposite position.

The resistance unit of the regulator is carried between the regulator and cut-out in the external controllers. On some machines this unit has but two leads, as shown in Drawing 453, or the two ends are joined with a jumper, as in the same drawing. In other units the unit has three leads with connections as shown in Drawing 455. In replacements, all resistance units and connections should be as shown in Drawing 455.

For machines using a one-wire ground-return system, the ground connection is made through the disconnect plug by means of a fillister head screw that locks the plug into place. Note precautions given below when adjusting the one-wire machine.

In the 12-volt machines the regulator has an additional coarse wire winding around it and the setting is made for both voltage and output in place of for voltage only as with 6-volt types.

The regulator is adjusted with a fully charged battery in the circuit and by adjusting the tension of the spring to secure the correct voltage, as given under Charge Rate, at 1000-1400 R. P. M.

Looking at the side of the regulator and with the disconnect plug toward the right, near the end farthest from the plug is a hole closed by a lead seal or by a seal and brass plug. The seal and plug are removed with a special spanner wrench. A small socket wrench is then passed through the hole and by turning this wrench to the right the generator voltage is raised. Turning it to the left lowers the voltage. Except with the 12-volt machines, the setting is made for voltage only without regard to amperage.

In adjusting the one-wire regulator it is possible to get a dead short unless the disconnect plug is freed and turned in a clockwise direction so that it locks in the disconnect position, away from the holes. The adjustment can be safely made by removing the plug entirely while altering the spring tension, then replacing the plug and testing the voltage or voltage and output.

BIJUR—CONTINUED

CUT-OUT: Magnetic, carried with regulator, either in the externally mounted controller or inside the generator.

Closes: 6-volt systems, at 6.5-7.0 volts; 12-volt systems, at 13.0-14.0 volts.

Opens with a discharge of 0.5-1.5 amperes.

Spring tension adjustment made with battery disconnected and head lamps turned on to furnish resistance load. Disconnect plug remains in place.

On external controllers, looking at the side of the box with the disconnect plug toward the right, there is a hole near the bottom and toward the disconnect plug end. This hole is closed by a lead seal or by a seal and brass plug. Seal and plug are removed with a special spanner wrench and a small socket wrench inserted through the hole. Turning this wrench to the right raises the cut in voltage; turning it to the left lowers the voltage.

STARTER: See Section 441 on Bijur Starting Motors.

DIAGRAMS: See Diagrams 451, 453 and 455.

BIJUR

CONSTANT VOLTAGE SYSTEM

TYPE: D-12 (internal controller).

VOLTAGE: 6.

CHARGE RATE: Adjust for 8.0 volts; 15.0 amperes maximum.

GENERATOR: Four-pole shunt wound machine with laminated field frame. Two brushes connected directly to terminals 1 and 2.

Test Terminals: Ammeter inserted in either line leading away from generator terminal 2 or 3. Voltmeter between terminals 1 and 2.

Shunt field between terminal for current limit stationary contact and terminal for cut-out series coil and stationary contact.

REGULATION: Constant voltage regulator operating on same principle as that described in preceding section, 401. In addition to the regulator there is a current limit relay to limit the maximum output to 15 amperes at any speed.

The regulator and current limit (also the cut-out) are carried inside the generator, but the adjustments are accessible from the outside.

The current limit should be adjusted with all lamps turned on to provide a suitable load.

The regular Bijur adjusting wrench is used for regulator adjustment. Turning the wrench right handed raises the voltage.

After the regulator, current limit, and cut-out have been adjusted, the reversing switch, which is mounted on the engine side of the dash, should be given a quarter turn while watching the ammeter to see that the needle shows an instantaneous reversal of current direction, then immediately resumes its normal position to the right of the zero mark. If the polarity fails to reverse properly, make a momentary connection between terminals 1 and 3 (shorting around the cut-out).

CUT-OUT: Magnetic, mounted inside the generator.

Closes at 6.5 volts; opens with discharge of 0.5-2.0 amperes.

The adjusting nut for the cut-out spring tension cannot be reached with a wrench and it is necessary to use a small pointed tool. Turning the nut right handed raises the cut in voltage.

STARTER: See Section 441 on Bijur Starting Motors.

DIAGRAM: See Diagram 452.

BIJUR

THIRD BRUSH GENERATORS, TWO TERMINALS, OUTSIDE FIELD FUSE

TYPES: L-61 and K-639.

VOLTAGE: 6.

CHARGE RATE: Normal hot setting is 14.0 amperes, 7.4 volts, at 1400-1600 R. P. M. Will give 2.0-3.0 amperes more when cold. Battery Sp. Gr. to be 1.250-1.275.

GENERATOR: Shunt wound, four field coils. Two main brushes set at 90 degrees from each other and on upper side of commutator. Regulating third brush on lower side and at right or left, depending on rotation.

Test Terminals: Ammeter between either generator terminal and wire removed. Voltmeter between the two terminals on the generator.

Field Terminals: Shunt field between third brush and clip for field fuse.

Field fuse of 10-ampere capacity under aluminum cover on front head.

REGULATION: Third brush controls field current and output. Moving this brush in the direction of armature rotation increases the output rate; against rotation lowers the rate.

Third brush is secured to the front head by two stud bolts whose nuts appear in a recess in the head. With the nuts loosened and the wrench still on one of them, the third brush assembly can be moved by tapping on the shank of the wrench. Moving the brush $\frac{1}{16}$ inch changes the output rate 2-3 amperes. The outside wires should be removed while shifting the brush.

CUT-OUT: Magnetic, mounted inside the generator at the commutator end.

Closes at 6.5-7.0 volts, 550 R. P. M. (approximate).

Opens with discharge of 0.5-1.5 amperes.

Spring tension adjusted by inserting special socket wrench in the adjusting hole on the generator head nearly opposite the field fuse position.

STARTER: See Section 441 on Bijur Starting Motors.

DIAGRAMS: ee Diagrams 457 and 464.

BIJUR

THIRD BRUSH GENERATORS, ONE-WIRE TYPES

TYPES: L-61 and P-210

VOLTAGE: 6.

CHARGE RATE: Bench setting, hot generator; battery Sp. Gr. 1.250 or more.

L-61.....14.0 amperes, 1400-1600 R. P. M., 7.4 volts.
P-210.....14.0 amperes, 1700-2000 R. P. M., 7.8 volts.

Charge Rates, cold average	L-61	P-210
600 R. P. M.	4.5 amps	3.0 amps.
900 R. P. M.	10.5 amps	8.0 amps.
1200 R. P. M.	13.0 amps	11.0 amps.
1500 R. P. M.	13.5 amps	13.0 amps.
1800 R. P. M.	12.5 amps	13.5 amps.
2100 R. P. M.	10.0 amps	12.5 amps.

Allowance of 1.0-1.5 amperes either way may be made from above values.

GENERATOR: Four-pole shunt wound machine with four field coils. Two brushes set at 90 degrees from each other and on upper side of commutator. Third brush below and at right or left, depending on rotation.

Test Terminals: Ammeter between generator terminal and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field winding between field fuse clip and third brush.

Field Fuse: 10-ampere fuse under a cover on the front head of the generator.

REGULATION: Third brush controls field current and output. Moving this brush with the direction of armature rotation increases the output rate; against rotation lowers the rate.

The third brush assembly is moved by inserting a special toothed adjusting wrench in the adjusting hole in the commutator end head of the generator. The wrench engages a pinion that shifts the brush ring.

CUT-OUT: Magnetic, mounted inside the generator at the commutator end.

Closes at 6.5-7.0 volts; 500-600 R. P. M.

Opens with discharge of 0.5-1.5 amperes.

Spring tension adjustment is made by inserting a special socket wrench into the adjusting hole found on the commutator end head of the generator nearly opposite the field fuse position. Turning the wrench to the right increases the cut in voltage.

STARTER: See Section 441 on Bijur Starting Motors.

DIAGRAMS: See Diagrams 459, 461, and 463.

BIJUR

THIRD BRUSH ROUND GENERATORS, OUTSIDE CUT-OUT

MODELS: L-220, P-230, K-230, and U-250.

CHARGE RATES: Higher rates will be secured with a cold generator, lower with hot generator or highly charged battery.

5.0 amperes at	650- 850 R. P. M.
7.5 amperes at	750-1000 R. P. M.
10.0 amperes at	900-1200 R. P. M.
11.5-14.5 amps. at	1400-1500 R. P. M.
12.5-15.0 amps., maximum, at	1600-2000 R. P. M.
9.0-12.0 amps., at	2500 R. P. M.

Bench setting, hot generator, battery Sp. Gr. 1.250 or more—

L-220	12.0 amperes, 1400-1800 R. P. M., 8.2 volts.
P-230	12.0 amperes, 1600-2000 R. P. M., 8.2 volts.

GENERATOR: Four-pole shunt wound machine with four field coils. Two brushes set at 90 degrees from each other and on upper side of commutator. Third brush below and toward right or left side, depending on direction of rotation.

Test Terminals: Ammeter in line from main brush to cut-out or between terminal on cut-out and wire removed. Voltmeter between metal ground connection and main brush from which line runs into cut-out.

Field Terminals: Shunt field coils in series between third brush and field fuse.

Field Fuse: 10-ampere fuse carried on main brush holder between main brushes (inside of generator housing).

Motoring Current: 6.0 amps, 6.1 volts, 360-380 R. P. M.

Field Current: L-220, 4.2 amperes; P-230, 5.5 amperes.

REGULATION: Third brush controls field current and output. Moving this brush with armature rotation increases the charge rate; moving it against rotation lowers the rate.

The third brush adjusting stud is on the commutator end head of the generator and is held by a lock nut. The stud moves the toothed sector carrying the brush by means of a small pinion so that the stud is turned in a direction opposite to that in which the third brush is to be rotated. With the lock nut loosened the stud can be turned with a screwdriver.

CUT-OUT: Magnetic, in metal box on top of generator. Cover sealed on one side.

Closes at 7.5-8.0 volts (hot); 7.0-7.5 volts (cold).

Opens with discharge of 1.0-2.0 amperes.

Spring tension is adjusted by bending the bridge at the pivoted end of the spring. Tension increases by bending bridge down.

Armature gap adjusted by bending the stop at the contact end of the armature.

STARTER: See Section 441 on Bijur Starting Motors.

DIAGRAM: See Diagram 466.

BIJUR

THIRD BRUSH GENERATOR, OUTSIDE CUT-OUT

TYPE: H-66.

VOLTAGE: 6.

CHARGE RATE: Setting, hot generator, battery Sp. Gr. 1.250 or more—

Maximum Charge Rates	Hot	Cold
600 R. P. M.	7.0 amperes	9.0 amperes
850 R. P. M.	14.0 amperes	16.0 amperes
1100 R. P. M.	16.0 amperes	18.0 amperes
1500 R. P. M.	14.5 amperes	16.0 amperes

GENERATOR: Four-pole shunt wound machine with four field coils.

Two brushes set at 90 degrees from each other on left-hand side of commutator. Third brush on opposite side from main brushes.

Test Terminals: Ammeter between terminal on cut-out and wire removed. Voltmeter between upper main brush and ground.

Field Terminals: Shunt field coils in series between third brush and upper brush-holder terminal.

REGULATION: Third brush controls field current and output. Moving this brush in the direction of armature rotation increases the output rate; moving it against rotation lowers the rate.

The third brush is held in place by two slotted nuts on studs attached to the holder. It is necessary to remove the cover plate over the third brush adjusting slot to reach these nuts. With them loosened the brush can be moved either way.

CUT-OUT: Magnetic, mounted on top of the generator.

Closes at 6.5-7.0 volts, 480 R. P. M.

Opens with discharge of 1.0-2.0 amperes.

The spring tension is adjusted by inserting the regular Bijur adjusting wrench in the hole in the left-hand end of the cut-out box (facing commutator end). Turning the wrench to the right increases the cut in voltage.

The cut-out cover is sealed in place.

STARTER: See Section 441 on Bijur Starting Motors.

DIAGRAM: See Diagram 465.

BIJUR

MOTOR-GENERATOR

TYPE: 1213.

VOLTAGE: 12.

CHARGE RATE:

Starts charge, balance speed.....725–750 R. P. M.
7.0–9.0 amperes maximum; setting.....1600–1800 R. P. M.

MOTOR-GENERATOR: Four pole machine with four field coils and two windings, shunt and series, in each coil.

Four main brushes, two positive and two negative, set at 90 degrees from each other; two positives joined together and two negatives joined together. Regulating, "third," brush carried between one positive and one negative brush.

Single armature and commutator with one armature winding used for both starting and generating.

Test Terminals: Ammeter between large right hand (negative) terminals and cable removed. Engine to be cranked by hand as this connection carries starting current. Voltmeter between this terminal and the large left hand (grounded) terminal.

Field Terminals: Shunt field coils in series between regulating brush and the small center terminal. Series field coils in series between the negative main brushes and the large right hand (negative) terminal.

REGULATION: Regulating brush controls field current and charge rate. Moving this brush with the direction of armature rotation increases the output, moving it against rotation lowers the output.

The brush adjustment is in a small recess at the bottom of the motor-generator head and held in place by two screws. With the screws loosened, the brush assembly can be moved in either direction for adjustment.

CUT-OUT: Manual with starting switch action. With the starting switch closed, the motor-generator is connected to the battery and the engine is cranked. When the engine drives the motor-generator at speeds of 725-750 R. P. M., or more, charging takes place; at lower speeds there is a discharge from the battery through the motor-generator.

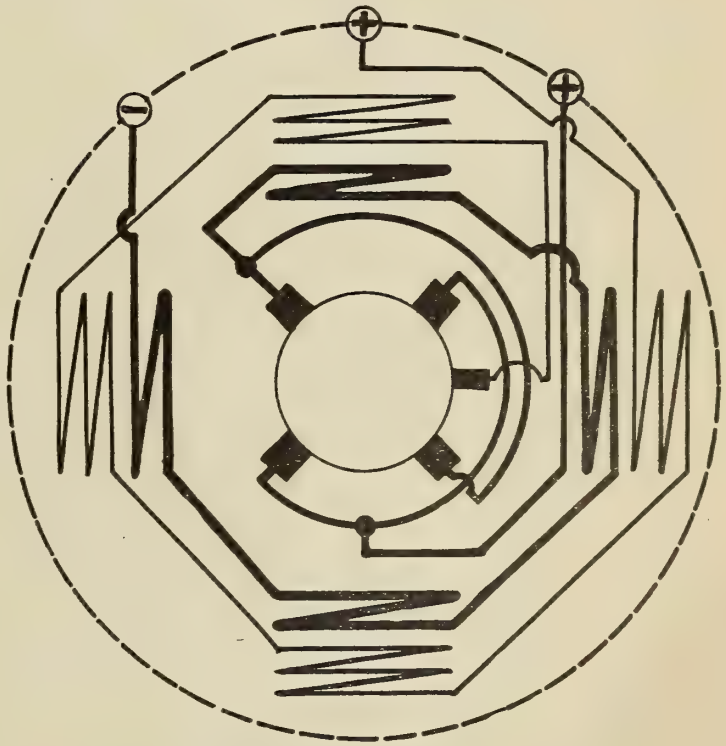
This unit is sometimes fitted with a three-position switch having an "Idle" position which disconnects the battery from the motor-generator but leaves the ignition turned on.

STARTER: The motor-generator acts as a four pole compound wound motor.

Runs free at 500-700 R. P. M. with 30-40 amperes.

Developes 2.3 ft.-lbs. torque with 100 amperes at 11.7 volts, running at 425-475 R. P. M.

DIAGRAM: See Diagram 469, below.



No. 469—Model 1213 Motor Generator

BIJUR

STARTING MOTORS

PERFORMANCE: When no gear ratio is given, the torque is measured from the armature shaft.

When a gear ratio is given, the torque is measured from the auxiliary or gear shaft.

Type	Model	Gear Ratio	Running Free		Locked		
			R.P.M.	Amperes	Volts	Amps.	Torque in Foot-Lbs.
A-14			5950	46	3.6	660	17.5
A-35			5300	35	3.6	640	27
A-37	12v		5900	17	7.8	400	22
A-42			3900	42	3.6	685	25.5
A-44			7600	37	3.0	750	19.8
B-64			7400	27	3.2	720	16.5
C- 3			6850	50	3.4	700	13
C- 8			4300	45	3.65	650	19.7
E-68	510		8000	37	3.5	700	13
E-68	510	2.9	2540	37	3.5	700	37
E-68			6900	34	3.8	610	17
E-160			7350	50	3.0	750	14.2
E-160		2.91	2530	50	3.0	750	41.6
F-65	460		10500	44	3.9	620	8.7
F-65	460	2.9	2570	65	3.9	620	27
F-65	581		10500	44	3.9	620	8.7
F-65	581	2.91	2570	65	3.9	620	27
XAD-200			5200	35		820	33
XED-160			6800	30	3.6	665	16.5
XFD-140			5800	27	4.25	545	12.5

BOSCH

CONSTANT VOLTAGE SYSTEM

VOLTAGE: 12.

CHAROE RATES: Due to constant voltage characteristics, the amperage will depend on the battery's state of charge. At 1000-1800 R. P. M. of dynamo, with battery Sp. Gr. 1.200 (low charge) the rate should be 8-10 amperes.

Setting is made for voltage and not for amperage. The regulator should be adjusted to maintain a voltage of 14.5-15.0 at ordinary running speeds.

GENERATOR: Two-pole shunt wound machine with two field coils. Two brushes set at opposite points on commutator.

Test Terminals: Ammeter between large generator terminal (1) and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field windings between large and small terminals on generator.

REGULATION: Constant voltage maintained by carbon-mica resistance regulator carried in dash panel on the right-hand side of this unit.

In the bottom of the regulator is a cup filled with carbon and mica particles. A plunger is pressed down on top of this mass by a spring and with the full spring pressure the resistance of the carbon-mica mixture is low. One end of the shunt field circuit is connected to the plunger, the other end to the lower part of the carbon-mica cup, so that the mass is in series with the field.

A voltage coil is carried around the plunger and as the dynamo voltage increases, the magnetism of this coil lifts the plunger, allowing the resistance of the carbon-mica to increase as it separates and the field current is reduced to maintain the desired voltage of setting.

There is an adjusting screw on the right-hand side and near the top of the regulator. Turning this screw in, to the right, increases the spring tension and voltage; turning the screw to the left lowers the voltage.

CUT-OUT: Magnetic, carried in left-hand side of dash panel.

Closes at 13.0-14.0 volts; opens with discharge of 0.0-2.0 amperes.

The cut-out spring is across the bottom of the unit. In the center of the spring is the adjusting nut. Turning this nut to the right, upward, increases the spring tension and voltage of closing. Turning it to the left lessens the spring tension and lessens the amperage for opening.

STARTER: Uses Rushmore starting motor, see Section 2151.

DIAGRAM: See Diagram 551.

BOSCH

STANDARD LIGHTING SYSTEM

TYPES: DSG—5, 6, 7, 8, 105, 106, 107, 108.

VOLTAGE: 6 volts for DSG6, DSG8, DSG106, DSG108.
12 volts for DSG5, DSG7, DSG105, DSG107.

CHARGE RATES: Maximum normal rates with cold generator and charged battery are as follows:

Type	Speed	Amperes	Volts	Note
DSG-5	2000 R. P. M.	7.0	15.0	
DSG-6	2000 R. P. M.	14.0	7.5-8.0	
DSG-7	1800 R. P. M.	8.5	15.0	
DSG-8	1800 R. P. M.	17.0	7.5-8.0	
DSG-105	3500 R. P. M.	5.0	15.0	lamps on
DSG-106	3500 R. P. M.	10.0	7.5-8.0	lamps on
DSG-107	2500 R. P. M.	6.0	15.0	
DSG-108	2500 R. P. M.	12.0	7.5-8.0	

GENERATOR: Two-pole machine with shunt and series windings, two field coils.

Two brushes set opposite each other on commutator.

Test Terminals: Ammeter between generator terminal 3 and wire removed. Voltmeter between terminals 1 and 3 on Types DSG 105 and 106; between terminals 1 and 4 on all other types.

Field Terminals: Shunt field windings between terminals 1 and 2. Series field windings between terminals 3 and 4.

Field fuse of 3-ampere capacity carried in dash unit with cut-out and 30-ampere main line fuse.

REGULATION: On all machines except Types DSG 105 and 106, the regulation is by reversed series field winding, the charging current passing through the series field windings in a direction to oppose the shunt field coils and limit the output.

On Types DSG 105 and 106 the machine operates as a straight shunt generator with lamps turned off. The lamp current passes through the series field windings which are compounded to assist the shunt windings and increases the output in proportion to the number and candlepower of lamps lighted.

No adjustment is provided.

CUT-OUT: Magnetic, carried in control box with main line and field fuses.

Closes on 6-volt machines at 6.5-7.5 volts; opens with discharge of 0.0-3.0 amperes. On 12-volt machines, closes at 13.0-15.0 volts; opens with discharge of 0.0-2.0 amperes.

Spring tension adjusted by bending the leaf spring on top of the armature with flat-nosed pliers.

Armature gap adjusted by turning adjusting screw passing through the armature near its pivoted end.

STARTER: Uses Rushmore starter in most cases. See Section 2151.

DIAGRAM: See Diagram 552.

BOSCH

THIRD BRUSH UNITS

TYPES: 1000, etc.

VOLTAGE: 6 or 12.

CHARGE RATES: For 4-inch diameter, 6-volt machines.

	Hot	Cold
Cut in	560 R. P. M.	500 R. P. M.
800 R. P. M	5.0 amperes	7.0 amperes
1200 R. P. M	9.0 amperes	13.0 amperes
1600 R. P. M	10.2 amperes	13–15 amperes
2400 R. P. M	8.0 amperes	11.0 amperes

For 5-inch diameter, 6-volt machines.

	Hot	Cold
Cut in	400 R. P. M.	460 R. P. M.
800 R. P. M	8.5 amperes	14.0 amperes
1300 R. P. M	13.2 amperes	17–19 amperes
1600 R. P. M	13.8 amperes	18.0 amperes
2000 R. P. M	12.5 amperes	15.5 amperes

GENERATOR: Four pole shunt wound machine with four field coils. Two main brushes on lower side of commutator and at 90 degrees from each other. Third brush on upper side of commutator.

Test Terminals: Ammeter between terminal on cut-out and wire removed or between terminal on generator and the cut-out. Voltmeter between either of the above mentioned terminals and ground.

Field Terminals: Shunt field coils in series between third brush and and the field fuse carried on the outside of the generator frame. Five-ampere field fuse under cover on frame.

REGULATION: Third brush controls field current and output. Third brush is moved with direction of armature rotation to increase output and against rotation to lower output.

The third brush holder is held by a single hexagon nut on a stud. This nut is accessible from the inside of the commutator end head and with it loosened the third brush assembly may be moved for adjustment.

CUT-OUT: Magnetic, carried on top of generator.

Closes at 6.7 to 7.3 volts at speeds as follows:

4-inch machines, 500-560 R. P. M.
5-inch machines, 400-460 R. P. M.

Opens with discharge of 1.0-2.0 amperes.

Adjustment made by altering armature air gap with stop which limits movement of armature.

STARTER: Four-pole series wound motor with four field coils. Two coils in series between motor terminal and one negative brush, other two coils in series between motor terminal and other negative brush. Positive brushes grounded. The two pairs of coils are thus in parallel with each other between the motor terminal (negative) and the negative brushes.

Performance of 4-inch diameter, 6-volt motor:

Running free	6000 R. P. M.	30 amperes	6.1 volts
5 Ft.-Lb. torque	725 R. P. M.	230 amperes	4.3 volts
10 Ft.-Lb. torque	200 R. P. M.	380 amperes	3.7 volts
15 Ft.-Lb. torque	lock	500 amperes	3.4 volts

DIAGRAMS: See Diagrams 553 and 554.

DEACO

THIRD BRUSH SYSTEM

MODELS: Generator SL, Motor GF.

VOLTAGE: 6.

CHARGE RATE:

	Driven at 1½ to 1	Driven at 1 to 1
500– 550 R. P. M.	7.0 amperes	4.5 amperes
750– 800 R. P. M.	12.0 amperes	11.0 amperes
1100–1200 R. P. M.	10.5 amperes	15.0 amperes
1400–1500 R. P. M.	9.5 amperes	13.5 amperes

Charge rates will be lower with hot generator.

GENERATOR: Four-pole shunt wound machine with four field coils. Two main brushes set at 90 degrees from each other. Third brush nearly opposite one main brush.

Test Terminals: Ammeter between either terminal on generator and wire removed (one terminal may be grounded). Voltmeter between the two terminals on the generator.

Field Terminals: Shunt field coils in series between third brush and the ungrounded (or negative) terminal of the generator.

REGULATION: Third brush controls field current and output. Moving this brush with the direction of armature rotation (farther from nearest main brush) increases the output, moving it against rotation lowers the output.

The third brush holder is fastened by two screws and with these screws loosened the brush assembly may be moved for adjustment.

CUT-OUT: Magnetic, mounted as separate unit.

Closes at 6.5-7.5 volts, 400-450 R. P. M. Opens with discharge of 0.5-1.5 amperes.

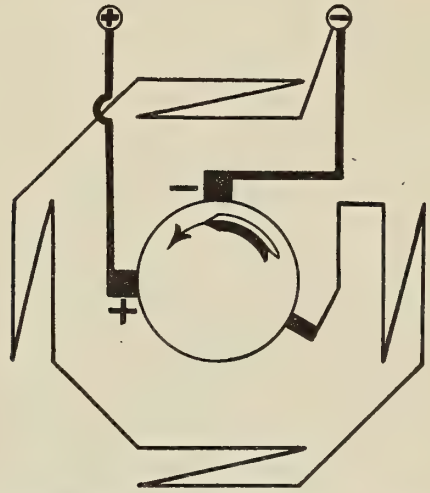
The armature gap is adjusted by the nut and stud passing through the armature near its pivoted end. The spring tension is adjusted by bending the leaf spring under the armature.

There are two pairs of contacts, one pair (carbon) outside and the other (copper) inside. The carbon contacts should be set to close first and open last so that they will take any spark occurring upon opening.

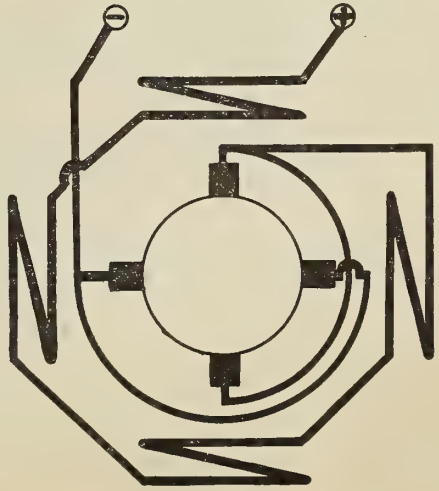
STARTER: Four-pole series wound motor with four brushes.

Starting switch has two contacts. On the first contact there is a resistance in series with the starting motor and battery. This allows the motor to revolve with little power while the gears are being meshed. With the starting switch fully closed, thus resistance is cut out.

DIAGRAMS: See Diagrams 658 and 659, below.



No. 658—Model S. L. Generator



No. 659—Model G. F. Motor

DELCO

MOTOR-GENERATOR, 6-24 VOLT SYSTEM

NUMBERS: 1, 2, 8, 9, 12, 15, 17, 18.

VOLTAGE: 6 while charging and for lamps, 24 for starting.

CHARGE RATES: With large meter hand set away from the stop, with double-strand charging shunt in use, and with generator warmed up after ten-minute run at normal output.

Number	1	2	8	9	12	15	17	18
Cut-in, R. P. M.	310	290	300	310	290	290	310	290
Amps. at 400 R.P.M.	3.0	5.6	5.6	3.0	5.8	5.8	5.6	5.8
Amps. at 800 R.P.M.	9.6	9.4	9.5	9.6	9.6	9.6	9.6	9.6
Amps. at 1200 R.P.M.	14.2	10.9	10.9	14.2	11.5	11.5	11.0	11.5
Amps. at 1600 R.P.M.	18.0	11.6	11.6	18.0	12.8	12.8	14.0	12.8
Maximum amperes	22.0	18.0	22.0	18.0	22.0	22.0	20.0	22.0

MOTOR-GENERATOR: Two-pole machine with either one or two field coils mounted above or above and below the armature and each containing both shunt and series windings. The armature has a single winding, one commutator, and one set of brushes; used for both charging and starting.

The system is of the two-wire, ungrounded type.

The single-coil machine has four terminals arranged lengthwise on top of the motor-generator and numbered 4, 3, 2, 1, from front to back.

The two-coil machine (one above and one below armature) has its four terminals arranged crosswise on top of the motor-generator and numbered 1, 2, 3, 4.

Test Terminals: Ammeter between motor-generator terminal 3 and the wire removed. Crank engine by hand, as this connection carries starting current. Voltmeter between motor-genera terminal 3 and motor-generator terminals 1 and 4 with 1 an temporarily connected with jumper.

Field Terminals: Shunt field between motor-generator terminals 2 and 3. Series field between motor-generator terminals 1 and 4.

REGULATION: Reversed series field connections while generating. In parallel with the series field winding is a "charging shunt" carried between two top stationary contact blade connections on the left-hand side of the controller switch. The field circuit divides between the field winding and this shunt. The shunts come in two sizes, single and double strand; single strand giving a low output, double strand a high output. If this shunt is replaced with wire, the charge rate will be excessively high.

In addition to the reversed series regulation, there is an ampere-hour meter operated by battery charge and discharge which controls a resistance in the shunt field circuit. The meter, with its contacts and resistance, is carried in the box ahead of the battery. The large hand on the meter runs clockwise on discharge and anti-clockwise on charge. With continued charge the meter hand strikes the contact fingers and opens first one set, then the second set. With both sets closed, the shunt field current has free passage; with the first set opened, the field current passes through the resistance; with both sets opened, the shunt field circuit is opened and the charge stopped. The contacts should be clean and the blades should have sufficient pressure to hold the contacts together.

If the meter contacts are beyond repair, they can be short circuited by placing a heavy wire between battery-box terminals 1 and 2, leaving a reversed series control. With this connection, the large meter hand should be removed. The entire meter can be removed for repair after connecting number 3 battery-box terminal to the bottom terminal on the left-hand side of the controller switch.

Once every two weeks the large meter hand should be raised and moved clockwise 20 points (but not past "70") in order to give the battery its necessary charge.

CUT-OUT: Magnetic, mounted above the controller switch in the box ahead of the battery.

DELCO—CONTINUED

Closes at 6.5 to 7.0 volts; opens with discharge of 0.0 to 1.0 ampere. Closing speeds given under **Charge Rates.**

Gap between armature and magnet core to be .032 in. with contacts closed; this being adjusted by bending the stationary contacts of the cut-out, making sure that both close at the same time.

Spring tension adjusted by bending the support at the outer end of the spring.

Shunt winding between the terminal at the side of the cut-out and the end terminal at the left (looking at the terminal end). Series winding between the two end terminals.

STARTER: Engine cranked at 20-30 R. P. M. with gear reduction of approximately 20 to 1.

Knife-blade commutating switch thrown from 6-volt (left) side to 24-volt (right) side when connected to the clutch pedal through the magnetic latch. The start button on the ignition switch closes a circuit around the cut-out and through the magnetic latch coil, causing the motor-generator to revolve slowly as a 6-volt series motor for gear meshing.

The switch blades should be kept clean and slightly oiled with light cylinder oil.

DIAGRAMS: See Diagrams 801, 802, 803, 805 and 806.

DELCO

MOTOR-GENERATOR, MERCURY-WELL REGULATOR, SLIDING CONTACT STARTING SWITCH

NUMBERS: 27, 28, 37, 38, 39. Rebuilt 27B, 28B, 37B, 38B, 39B.

VOLTAGE: 6.

CHARGE RATES: Straight shunt test, without regulator, and with machine warmed up by run at 12-15 amperes.

For machines as originally built to operate with mercury-well voltage regulator—

Number	27	28	37	38	39
Cut-in, R. P. M.	485	485	450	475	450
Amps. at 600 R. P. M.	5.3	5.3	7.5	6.0	7.5
Amps. at 900 R. P. M.	13.8	13.8	16.0	14.5	16.0
Amps. at 1200 R. P. M.	20.5	20.5	21.6	21.0	21.6
Amps. at 1500 R. P. M.	26.0	26.0	26.0	26.0	26.0
Maximum amperes	40.0	40.0	40.0	40.0	40.0

For rebuilt machines operating with reversed series regulation—

Number	27B	28B	37B	38B	39B
Cut-in, R. P. M.	475	350	475	400	350
Amps. at 600 R. P. M.	4.0	7.5	4.0	6.0	7.5
Amps. at 900 R. P. M.	9.0	10.5	9.0	10.0	10.5
Amps. at 1200 R. P. M.	11.8	12.5	11.8	12.0	12.5
Amps. at 1500 R. P. M.	14.0	14.0	14.0	14.0	14.0
Maximum amperes	22.0	22.0	22.0	22.0	22.0

GENERATOR: Two-pole machine with single coil above armature containing generating shunt winding and starting series winding.

Armature has two separate windings, with generator commutator at front end and starting commutator at rear end. Two brushes on each commutator, both being in constant contact with commutator.

Single-wire system with negative side grounded.

Test Terminals: Ammeter between main, or larger, of two terminals on top of motor-generator and the left-hand terminal of the cut-out. Voltmeter between large terminal on top of motor-generator and ground.

Motoring, with "Start" button closed, takes 4.5-5.0 amperes.

Field Terminals: Shunt field between two terminals on top of motor-generator. Series field between ungrounded motor brush and large cable to starting switch.

REGULATION: Constant voltage system using mercury-well regulator carried in apparatus box.

Some of these machines have been rebuilt, changing them to a reversed series generator and doing away with the mercury-well regulator.

The regulator maintains an approximate voltage of 7.0. It consists of a coil of wire (voltage coil) surrounding the mercury tube and acted upon by the generator voltage. The tube is a hollow cylinder of german silver lined with insulating varnish and having two pools of mercury inside, the pools separated from each other by an insulating cylinder of bakelite. A hollow steel plunger, within which is a long steel needle, moves up and down in the mercury, the plunger in the outer pool and the needle in the inner pool. The two pools of mercury are connected by a resistance wound on the lower portion of the steel plunger, this resistance being insulated from the plunger by sheet mica. One end of the resistance is connected to the steel needle and the other to the steel tube. That portion of the resistance wire that is above the surface of the mercury is inserted in the shunt field circuit, while the portion below the mercury is short circuited by the mercury. With a rise of voltage, the attraction of the voltage coil for the steel plunger causes the plunger to rise in the tube, inserting more of the resistance in the field circuit and reducing the voltage.

The shunt field (small) terminal of the motor-generator is connected to the bottom terminal of the mercury tube and the outer cylinder of the tube is grounded to the base of the apparatus box, so that the shunt field is grounded through the mercury tube to the metal of the base of the apparatus box (except during cranking) and thence to the frame.

There is a rheostat below the voltage coil and turning its indicator clockwise (looking down from the top) increases the charge rate. This is for temperature compensation, as a rise of temperature reduces the charge rate.

CUT-OUT: Magnetic, mounted in the apparatus box together with the voltage regulator, and, in some cases, the ignition relay.

Closes at 6.2 to 7.0 volts, 450-500 R. P. M.; opens with discharge of 0.0 to 1.0 amperes.

Gap between armature and magnet core to be .032 in. with contacts closed; this being adjusted by bending the stationary contacts, making sure that both pairs close at the same time.

DELCO—CONTINUED

Spring tension is adjusted by bending the spring support at the upper end of the spring.

Shunt winding between contact points and the cut-out base on the apparatus box. Series winding between the contact points and the left-hand terminal.

A target shows through a shutter in the apparatus-box cover, showing white with the cut-out closed and black with it open.

STARTER: Pressing the start button on the switch (Delco Switch No. 1040) closes circuit between terminals 8 and 9 and completes circuit around cut-out. This causes rotation of the motor-generator as a shunt motor with the armature running clockwise, looking from the front.

Pressing the starting pedal first meshes the gears, then releases the trigger in the starting switch, allowing the switch to close and connect terminals 1 and 2, while disconnecting the generator circuit from the apparatus-box ground.

The starter switch contact blocks and the bakelite cover must be kept free from oil, which would cause burning of the bakelite. The contacts can be resurfaced, but burned bakelite must be replaced, as must also the spring cradle which holds the contacts against the cover.

DIAGRAMS: See Diagrams, 807, 809, 811.

DELCO

MOTOR-GENERATOR, MERCURY-WELL REGULATOR, SLIDING-CONTACT STARTING SWITCH

NUMBERS: 3, 4, 6.

VOLTAGE: 6

CHARGE RATES: Straight shunt test, without regulator, and with machine warmed up by run at 15-20 amperes.

Number	3	4	6
Cut-in, R. P. M.	300	300	280
Amps. at 400 R. P. M.	6.5	6.5	7.0
Amps. at 800 R. P. M.	17.8	17.8	18.5
Amps. at 1200 R. P. M.	23.9	24.6	25.0
Amps. at 1600 R. P. M.	26.8	28.8	29.0
Maximum amperes	40.0	40.0	40.0

GENERATOR: Two-pole machine with two coils, one above and the other below the armature, each containing the generating shunt winding and the starter series winding.

Armature has two separate windings with both commutators at front end; motor commutator large, generator commutator small size.

Two-wire system, ungrounded.

Test Terminals: Ammeter between inside (1) terminal on top of motor-generator and wire removed. Voltmeter between inside (1) terminal and third terminal from inside (3) on top of motor-generator.

Field Terminals: Terminals on top of motor-generator numbered 1, 2, 3, 4, from inside to outside. Shunt field between terminals 2 and 3. Series field between positive (inside) motor brush and lead from motor-generator to starter switch.

REGULATION: Same as preceding section, 702.

CUT-OUT: Same as preceding section except that the shunt winding is between the contact points and the right-hand terminal.

STARTER: Same as preceding section.

DIAGRAMS: See Diagrams 810, 813.

DELCO

MOTOR-GENERATOR, MERCURY-WELL REGULATOR, MOTOR BRUSH STARTING SWITCH

NUMBERS: 20, 22, 24, 35, 54, 54B.

VOLTAGE: 6.

CHARGE RATES: Straight shunt test, without regulator, and with generator warmed up by 10-minute run.

Number	20	22	24	35	Original 54	Re-built 54B
Cut-in, R. P. M.....	360	350	300	390	450	475
Amps. at 600 R. P. M.	10.2	9.0	13.0	8.0	7.6	4.0
Amps. at 900 R. P. M.	16.0	12.5	19.8	11.4	16.0	9.0
Amps. at 1200 R. P. M.	20.3	14.0	24.5	13.7	21.7	11.8
Amps. at 1500 R. P. M.	22.0	16.5	28.0	15.8	26.0	14.0
Maximum amperes	40.0	20.0	40.0	20.0	40.0	22.0

GENERATOR: Two-pole machine with generating shunt winding and series starter winding in field coils. Numbers 20, 24, and 35 have two field coils, one above and the other below the armature. Numbers 54 and 54B have a single coil above the armature.

Armature has two separate windings with both commutators at front end; large motor commutator and small generator commutator.

One-wire system; negative ground on 20, 22, 54, and 54B. Positive ground on 24 and 35.

Test Terminals: Ammeter between left-hand terminal on cut-out and wire removed. Voltmeter between left-hand terminal of cut-out and ground.

Field Terminals: Shunt field between line to left-hand terminal of cut-out and line to bottom of voltage regulator. Series field between large terminal on motor-generator and stationary motor brush.

REGULATION: Same as preceding section, 702.

CUT-OUT: Magnetic, mounted in the apparatus box with voltage regulator.

Closes at 7.0 volts; opens with discharge of 0.0 to 1.0 amperes.

Gap between armature and magnet core to be .032 in. with contacts closed; adjusted by bending stationary contacts, making sure that both pairs close at same instant.

Spring tension adjusted by bending spring support at upper end.

Shunt winding between contact points and cut-out base ground on apparatus box. Series winding between contact points and left-hand terminal.

STARTER: Pressing the start button on the switch completes a circuit around the cut-out and causes rotation of the motor-generator as a shunt motor with the armature running clockwise, looking from the front end.

Attached to the motor brush arm is a long phosphor bronze contact which opens when the motor brush is dropped onto its commutator.

This opens the generator circuit while cranking. The motor brush is operated through a bell crank from an extension of the rod which meshes the gears.

SWITCHES: Number 20 and 22 use switch 1033; number 24 uses switch 1042; number 35 uses switch 1044; numbers 54 and 54B use switch 1035. See Diagram 871.

DIAGRAMS: See Diagrams 812, 815, 816 and 829.

DELCO

MOTOR-GENERATOR, JUNIOR SYSTEM, 1914

NUMBERS: 26, 31, 32, 33, 40, 41, 42, 60.

VOLTAGE: 6.

CHARGE RATES: With generator warmed up by run at 10-12 amperes

Number	26	31	32	33	40	41	42	60
Cut-in, R. P. M.	350	350	350	350	350	350	350	350
Amps. 600 R. P. M.	5.8	5.0	5.8	5.8	5.9	5.9	5.9	5.0
Amps. 900 R. P. M.	10.2	8.8	10.2	10.2	10.3	10.3	10.3	8.8
Amps. 1200 R. P. M.	13.2	11.6	13.2	13.2	13.4	13.4	13.4	11.6
Amps. 1600 R. P. M.	15.0	13.5	15.0	15.0	15.4	15.4	15.4	13.5
Maximum Amps.	20.0	20.0	20.0	20.0	20.0	20.0	20.0	16.0

GENERATOR: Single field coil carried above armature. Coil contains shunt, reversed series and starting series winding.

Single armature with two separate windings, each with its own commutator. Both commutators at front end; large for starting, small for generator.

Test Terminals: Ammeter; disconnect lead from field to top generator brush and place meter between end of lead and brush. Voltmeter between right-hand terminal on cut-out and ground.

Field Terminals: Shunt field between top generator brush and ground. Reversed series field between top generator brush and right-hand terminal on cut-out. Starting series field between top motor brush and large terminal on motor-generator.

Shunt field current; 1.5 amperes at 6.0 volts.

Single-wire system, negative grounded.

REGULATION: Reversed series field opposes shunt field to limit output; no adjustment provided.

CUT-OUT: Magnetic, mounted in upper part of rear end of motor-generator housing; accessible with top cover removed.

Closes at 7.0 to 7.5 volts; 350 R. P. M. (with starter pedal released to allow contacts to operate).

Opens with discharge of 0.0 to 1.0 ampere.

Gap between armature and magnet core to be $\frac{1}{32}$ in. with contacts closed; adjusted by bending stationary contacts, making sure that both pairs close at same instant.

Spring tension adjusted by bending support at upper end.

Shunt winding between contacts and ground connection to housing. Series winding between contacts and right-hand terminal (leading to field).

STARTER: When starting lever or pedal is pressed, the motor brush shifting rod is drawn back and the cut-out contacts are pressed together by the rod, allowing motoring as a shunt motor with armature running clockwise, looking from front end.

With starting lever or pedal fully depressed and the gears meshed the lower generator brush is moved away from its commutator, opening the charging circuit, and immediately afterward the top motor brush is lowered onto its commutator, completing the starting circuit.

DIAGRAM: See Diagram 817.

DELCO

MOTOR-GENERATOR AND GENERATOR, REVERSED SERIES MACHINES, 1915, 1916

NUMBERS: 53, 56, 61, 67, 71, 74.

VOLTAGE: 6.

CHARGE RATES: With generator warmed up by run at 12-15 amperes.

Number	53	56	61	67	71	74
Start Charge.....	350	350	450	400	450	350
Amps. 600 R. P. M.	6.0	6.0	4–5	5.0	4–5	6.0
Amps. 900 R. P. M.	10.2	10.2	7.5–9	9.0	7.5–9	10.2
Amps. 1200 R. P. M.	13.7	13.7	10–11.5	12.5	10–11.5	13.7
Amps. 1600 R. P. M.	16.5	16.5	11–12.2	15.0	11–12.2	16.5
Maximum Amps.....	22.0	22.0	13.5–17	22.0	13.5–17	22.0

GENERATOR: Single field coil carried above armature. Coil contains shunt, reversed series and starting series windings.

Single armature with two separate windings, each with its own commutator. Both commutators at front end; large for starting, small for generating.

Test Terminals: Ammeter between small (upper) terminal on motor-generator and wire removed. Voltmeter between small (upper) terminal on motor-generator and ground.

Field Terminals: Shunt field between ground and small terminal on motor-generator. Reversed series field between upper generator brush and small terminal on motor-generator. Starting series field between upper motor brush and large terminal on motor-generator.

Single-wire system; negative grounded.

REGULATION: Reversed series field opposes shunt field to limit output. No adjustment provided.

CUT-OUT: Manual through contacts on ignition switch, number 1 48. See Diagram 877.

With either the M or B ignition button pulled out, in addition to completing the ignition circuit, the generator is connected to the battery through additional contacts on the switch. Circuit—from battery positive to large motor-generator terminal, to No. 1 on switch, through auxiliary contacts, to No. 6 on switch, to small terminal on motor-generator, through reversed series and shunt fields and armature. This allows motoring while the gears are meshed and a discharge from the battery until the motor-generator speed is sufficient to start charge.

STARTER: Same as preceding section.

DIAGRAM: See Diagram 818.

DELCO

MOTOR-GENERATOR, GOVERNOR REGULATION, 1915 STANDARD SYSTEM

NUMBERS: 44, 45, 49, 50, 51, 52, 57, 58, 59, 63, 64, 66.

VOLTAGE: 6.

CHARGE RATES: With generator warmed up by ten-minute run at 12-15 amperes.

Number	44	45	49	50
Starts Charge	350	350	350	350
Amps. at 500 R. P. M.	8.0–11.0	4.5–10.0	4.5–10.0	4.5–10.0
Amps. at 650 R. P. M.	13.0–16.4	10.4–15.2	10.4–15.2	10.5–15.0
Amps. at 850 R. P. M.	16.0–20.0	15.2–19.0	15.2–19.0	15.5–19.0
Amps. at 1000 R. P. M.	14.9–19.0	16.2–20.0	16.0–20.0	16.5–20.0
Amps. at 1200 R. P. M.	12.5–17.0	14.0–18.0	14.0–18.0	14.0–18.0
Amps. at 1400 R. P. M.	10.0–15.0	10.5–15.3	10.5–15.2	10.5–15.0

Number	51	52	57	58
Starts Charge	350	510	350	510
Amps. at 500 R. P. M.	4.5–10.0	.....	4.5–10.0	.....
Amps. at 650 R. P. M.	10.4–15.2	4.5–11.0	10.4–15.2	4.5–10.5
Amps. at 850 R. P. M.	15.2–19.0	10.0–19.0	15.2–19.0	10.5–17.5
Amps. at 1000 R. P. M.	16.2–20.0	13.0–22.0	16.0–20.0	14.0–20.0
Amps. at 1200 R. P. M.	14.0–18.0	12.8–20.5	14.0–18.0	16.0–22.0
Amps. at 1400 R. P. M.	10.5–15.3	12.0–18.5	10.5–15.2	13.5–19.5

Number	59	63	64	66
Starts Charge	350	500	350	350
Amps. at 500 R. P. M.	4.5–10.0	.....	4.5–10.0	4.5–10.0
Amps. at 650 R. P. M.	10.4–15.2	5.0–10.0	10.4–15.2	10.5–15.0
Amps. at 850 R. P. M.	15.2–19.0	11.0–18.0	15.2–19.0	15.5–19.0
Amps. at 1000 R. P. M.	16.2–20.0	13.0–20.0	16.0–20.0	16.5–20.0
Amps. at 1200 R. P. M.	14.0–18.0	12.5–18.0	14.0–18.0	14.0–18.0
Amps. at 1400 R. P. M.	10.5–15.3	11.0–16.5	10.5–15.2	10.5–15.0

GENERATOR: Two-pole machine with single field coil carried above armature and having shunt and series windings in same coil.

Single armature with two separate windings, each with its own commutator. Generator commutator at front of armature, motor commutator at rear.

Test Terminals: Ammeter between small (front) terminal on motor-generator (leading to No. 6 on switch) and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between ungrounded generator brush and lead to bottom of regulating resistance spool. Leads from both ends of the shunt field are brought out on the forward side of the coil. Series field between stationary motor brush and large cable terminal on motor-generator.

Single-wire system. Negative grounded except on No. 44, which grounds positive.

REGULATION: Output controlled by field resistance rheostat operated by centrifugal governor according to generator speed. Resistance consists of nichrome wire wound on a non-inflammable spool and mounted in the ignition distributor housing back of the condenser at the front end of the motor-generator. The shunt field is connected to the bottom of this spool and the top of the spool is grounded through the ignition resistance, so that with all of the resistance in circuit the shunt field could ground in this manner. A rheostat arm is operated from the ignition distributor shaft and is caused to rise with increase of speed through the action of a centrifugal weight attached to the arm. One end of the arm rests on the resistance spool, while the other end is grounded. With the arm at the bottom of the spool, the shunt field grounds through the arm without using the resistance. As the arm rises, more and more of the resistance is included in the shunt field circuit, thus controlling the output of the generator.

Six sizes of wire are used on resistance spools; the size, together with the length of the brass caps on the ends of the spools, allowing adjustment of the output.

Spool No. 633 uses 21 gauge wire (.028″ diam.) lowest output
Spool No. 703 uses 22 gauge wire (.025″ diam.)
Spool No. 702 uses 23 gauge wire (.022″ diam.)
Spool No. 701 uses 24 gauge wire (.020″ diam.)
Spool No. 817 uses 25 gauge wire (.017″ diam.)
Spool No. 955 uses 26 gauge wire (.015″ diam.) highest output

Generators driven at or near engine speed usually use spool No. 702, sometimes No. 701 or No. 703. Motor-generator 52 often uses spool No. 817. Motor-generator 58 often uses spool No. 955.

The spool should be firmly held by its spring. The contact arm should have at least 6 ounces pressure on the spool, but not enough to make it stick when raised with the fingers. The end of the arm should rest on the lower brass cap of the spool when the generator is at rest. The spool bracket can be raised or lowered by loosening the two screws through the bracket; the holes in the bracket being slotted for this purpose.

DELCO—CONTINUED

Using a larger size resistance wire on the spool allows a higher charge rate after the maximum point has been passed, that is, there is not as sharp a falling off in output. The maximum rate is also slightly increased.

Both maximum rate and high-speed rate are increased by installing the resistance spool with the wide brass cap at the bottom; the rate is decreased by placing the wide cap at the top.

CUT-OUT: Manual through contacts on ignition and lighting switch. Switch No. 1048 is used with motor-generators 45, 49, 50, 51, 52, 55, 57, 58, 59, 64. See Diagram 877.

Switch No. 1045 is used with No. 44, and switch No. 1055 is used with No. 66. See Diagram 872.

With either the M or B ignition button pulled out, in addition to completing the ignition circuit, the generator is connected to the battery through additional contacts on the switch. The circuit is from the battery to the large cable terminal on the motor-generator, to No. 1 on switch, through auxiliary contacts, to No. 6 on switch, to small front terminal on motor-generator, causing the armature to revolve as a shunt motor in a clockwise direction (looking from the front) with a discharge of 4-5 amperes for motoring and about 2 amperes for ignition at low speeds. This allows the gears to be meshed. The discharge continues until the speed reaches 350-500 R. P. M., after which charging commences.

STARTER: The grounded motor brush is normally held away from its commutator with the machine idle or generating. With the starter pedal pressed, the brush is dropped onto its commutator to complete the starting circuit and the long phosphor bronze switch blade attached to the motor brush arm opens the generator circuit.

SWITCH: A circuit breaker of the vibrating type is carried on the combination switch. It requires 25 amperes to start the breaker to vibrating, after which 3-5 amperes will keep it operating.

DIAGRAM: See Diagram 819.

DELCO

GENERATOR WITH GOVERNOR REGULATION, SEPARATE MOTOR

NUMBERS: Generator 62; starting motor 63.

VOLTAGE: 6.

CHARGE RATE: With generator warm.

Starts Charge	625 R. P. M.
800 R. P. M.	6.0– 8.5 amperes
1000 R. P. M.	9.5–12.0 amperes
1600 R. P. M.	13.0–16.0 amperes
1800 R. P. M.	12.0–15.0 amperes
2000 R. P. M.	11.0–14.0 amperes

GENERATOR: Two-pole machine with shunt field carried above armature.

Test Terminals: Ammeter between cut-out contacts and line leading to No. 6 on switch. Voltmeter between cut-out contacts and ground.

Field Terminals: Shunt field between right-hand terminal on cut-out and top of regulating resistance spool.

Single-wire system with negative grounded.

REGULATION: Same as preceding section.

CUT-OUT: Magnetic, carried in generator housing.

Closes at 7.0-7.5 volts, 350-400 R. P. M.; opens with discharge of 0.0 to 1.0 amperes.

Gap between armature and magnet core to be .032 in. with contacts closed; adjusted by bending stationary contacts, making sure that both pairs close at same instant.

Spring tension adjusted by bending support at upper end.

Shunt winding between contacts and ground connection to housing. Series winding between contacts and right-hand terminal (leading to field and brush).

STARTER: Four-pole, four-brush, series wound motor. Single-contact, single-pole starting switch.

Four field coils in two pairs, each pair having two coils in series and the two pairs in parallel. Current from battery flows through the fields, then to two positive brushes, through armature to two negative brushes, and to ground.

SWITCH: Uses combination switch No. 1056. See Diagram 880.

DIAGRAM: See Diagram 819.

DELCO

MOTOR-GENERATOR, CONSTANT CURRENT REGULATOR

NUMBERS: 65 and 77.

VOLTAGE: 6.

CHARGE RATE:

0 amperes, starts charge	350–450 R. P. M.
3–4 amperes	400–500 R. P. M.
7.5–10 amperes	475–675 R. P. M.
12–13 amperes	600–750 R. P. M.
13–16 amperes maximum, above	750–850 R. P. M.

GENERATOR: Two-pole machine with single field coil carried above armature. Coil contains three windings; shunt, reversed series, and starting series.

Single armature with two separate windings and two commutators. Generator commutator and brushes at front end, motor commutator and brushes at rear.

Test Terminals: Ammeter between outside top terminal (2) on motor-generator and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between top generator brush and connection to regulator contacts and resistance coils. Reversed series field between top generator brush and connection to regulator current coil (No. 2 terminal). Starting series field between stationary motor brush and large cable to battery.

Single-wire system with negative grounded.

REGULATION: Reversed series field opposes shunt field to limit output at generator speeds below 750-850 R. P. M. Above these speeds, a vibrating type of current regulator acts to maintain a constant current of 15 amperes.

Current regulator coil includes three windings; one, the main current coil in series with the reversed series field and carrying the charging current; second, a small wire connected across the regulator tungsten contacts and wound to oppose the current coil; third, a resistance winding also connected across the contacts and through which the shunt field current is forced when the contacts are open.

Spring tension is adjusted by screw and nut at rear end of spring. Armature gap adjusted by screw and nut on contact point carried by armature.

Output raised by increasing spring tension or decreasing gap between magnet core and armature; lowered by decreasing spring tension or increasing gap.

CUT-OUT: Manual through contacts on ignition and lighting switch. Switch No. 1048 used with 65, switch No. 1056 used with 77. See Diagrams 877 and 880.

With either the M or B ignition button pulled out, in addition to completing the ignition circuit, the generator is connected to the battery through additional contacts on the switch plungers. The circuit is from the battery positive through the large cable and the starting series field to the inside terminal (1) on top of the motor-generator, then to No. 1 on the switch, through the auxiliary contacts to No. 6 on the switch, to the outside terminal (2) on top of the motor-generator, through the regulator current coil and the reversed series field winding to the armature. This discharge continues until the speed reaches 350-400 R. P. M.

STARTER: The grounded (outside) motor brush is normally held away from its commutator with the machine idle or generating. With the starter pedal pressed, the brush is dropped onto its commutator to complete the starting circuit and the long phosphor bronze switch blade attached to the motor brush arm opens the generator circuit, which is grounded through this contact.

SWITCH: A circuit breaker of the vibrating type is carried on the combination switch. It requires 25 amperes to start the breaker vibrating, after which 3-5 amperes will keep it in operation.

DIAGRAM: See Diagram 820.

DELCO

MOTOR-GENERATOR, THIRD BRUSH REGULATION

NUMBERS: 68, 69, 73, 75, 76, 81, 83, 90, 93.

VOLTAGE: 6.

CHARGE RATES: With generator warmed up by ten-minute run at full output and with fully charged battery. Variations in setting of third brush allow range of from 12 to 20 amperes maximum charge.

Number	68	69	73	75
Starts Charge	380	400	400	380
Amps. at 600 R. P. M.	9.5–13.2	5.2– 8.7	6.0–10.0	9.5–13.2
Amps. at 800 R. P. M.	14.5–18.3	9.8–13.5	11.8–17.0	14.5–18.3
Amps. at 1000 R. P. M.	16.0–20.0	13.0–14.5	15.8–20.0	16.0–20.0
Amps. at 1300 R. P. M.	12.0–17.0	12.0–14.5	12.6–17.0	12.0–17.0
Amps. at 1600 R. P. M.	9.5–14.0	12.0–14.5	9.5–14.0	9.5–14.0

Number	76	81	83	90	93
Starts Charge	400	400	400	380	400
Amps. at 600 R. P. M.	8.0–10.0	6.0–10.0	6.0–10.0	5.0 –8.5	6.0–10.0
Amps. at 800 R. P. M.	11.5–14.0	11.8–17.0	11.8–17.0	9.5–13.0	11.8–17.0
Amps. at 1000 R. P. M	13.0–15.0	15.8–20.0	15.8–20.0	12.5–14.0	15.8–20.0
Amps. at 1300 R. P. M.	10.8–12.5	12.6–17.0	12.6–17.0	10.0–12.0	12.6–17.0
Amps. at 1600 R. P. M.	8.8–10.8	9.5–14.0	9.5–14.0	8.5–11.0	9.5–14.0

GENERATOR: Two-pole machine with single field coil above armature. Coil contains generating shunt winding and starting series winding.

Single armature with two separate windings; generator commutator at front, motor commutator at rear.

Test Terminals: Ammeter between small terminal toward front of motor-generator and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between third brush and lead coming out above large motor-generator terminal and going to ignition coil and switch.

Single-wire system, negative grounded.

REGULATION: Third brush controls field current and output. Third brush mounted above commutator and toward right-hand side. Rate is increased by moving third brush with armature rotation toward right-hand (negative) main brush.

The third brush arm is made in two parts and by loosening the two screws, the brush can be moved in either direction.

CUT-OUT: Manual through additional contacts on ignition switch plunger, these contacts being closed while the ignition switch is on. Circuit is from battery positive through large cable to large terminal on motor-generator, then to ammeter, through charging contacts on switch to No. 2 switch terminal, to small terminal near front of motor-generator and to generator brush. This allows motoring of the generator while the starting gears are meshed. The discharge of 5-6 amperes continues until the generator is driven at 380-400 R. P. M.

STARTER: With the starter pedal depressed the gears are meshed and the pin is withdrawn so that the right-hand motor brush is dropped onto its commutator to complete the starting circuit. At the same time the generator switch above the motor brush is opened, breaking the charging circuit from generator to battery.

SWITCHES:

Number	Switches	Diagrams
68	No. 1058	883
69	No. 1057	882
73	No. 1057, 1058, 1064, 1067	882, 883, 881
75	No. 1058	883
76	No. 1057	882
81	No. 1058	883
83	No. 1065, 1066, 1067, 1104	882, 883
93	No. 1065	882

A vibrating circuit breaker is carried on the switch. The breaker starts to vibrate with 25 amperes and continues to operate with 3-5 amperes.

DIAGRAM: See Diagram 821.

DELCO

BUICK MOTOR-GENERATORS, THIRD BRUSH REGULATION

NUMBERS: 70, 94, 115, 117, 121, 128, 184, 190.

VOLTAGE: 6.

CHARGE RATES: With generator warmed up by run at 12-15 amperes and with charged battery.

Numbers	70-94	115	121	117, 128, 184, 190
Start Charge	600	600	600	550
Amps at 700 R. P. M.	4.5- 5.0	2.0- 3.0	4.0- 4.5	4.5- 5.2
Amps at 1100 R. P. M.	11.0-13.0	9.5-11.3	10.5-13.0	11.0-13.0
Amps at 1500 R. P. M.	12.0-15.0	12.0-15.0	12.0-15.0	12.0-15.0
Amps at 1800 R. P. M.	11.5-14.5	11.5-14.5	11.5-14.5	11.5-14.5

GENERATOR: Two pole machine with single field coil above armature. Coil contains generating shunt field and starting series field windings.

Single armature with two separate windings and two commutators. Both commutators on front end; large one next armature is motor commutator, small one in front is generator commutator.

Lower brushes for both generator and motor are stationary. Upper motor brush acts as starting switch; upper generator brush is lifted during cranking to open generator circuit.

Test Terminals: Ammeter between lower small terminal on rear of motor-generator and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between third brush or the terminal on front of field coil and the terminal on the rear of coil or line running from rear of motor-generator housing to ignition coil and switch. Series field between top motor brush and large terminal on rear of motor-generator.

Single wire system, negative grounded.

REGULATION: Third brush controls field current and output. Third brush mounted below commutator and to right of lower main brush (looking at commutator end). The brush is carried by a plate attached to the bottom of the housing under the commutators at the front end. Holes for the fastening screws of the plate are slotted or may be slotted.

To increase the charge rate, the plate is moved to the left (looking at the front end). This moves the third brush clockwise, with the direction of armature rotation. With this type of mounting it is important that the third brush be re-fitted after adjusting.

CUT-OUT: Manual, circuit between generator and battery closed by additional contacts operated with the ignition contacts in the combination switch. This allows motoring of the generator while the starter gears are meshed. The discharge of 5-6 amperes continues until the generator is driven at 550-600 R. P. M., when charging commences.

On the switches having four plungers (1057, 1066, 1103, 1104), and on those having two handles or keys (1075, 1095) the circuit is as follows: Battery positive through cable to large terminal on rear of motor-generator, to ammeter or switch terminal No. 1, through auxiliary contacts to switch terminal No. 2, to small terminal on rear of motor-generator.

On round switches No. 1133 and No. 1158 the circuit is as follows: Battery positive through cable to large terminal on rear of motor-generator, to ammeter, to terminal No. 6 on switch, through charging contacts to switch terminal No. 5, to small terminal on rear of motor-generator.

On round switch No. 1159, the circuit is as follows: Battery positive through cable to large terminal on rear of motor-generator, to ammeter, to terminal No. 1 on switch, through charging contacts to switch terminal No. 2, to small terminal on rear of motor-generator.

STARTER: Operation of the starter switch, after the generator is motoring with the ignition switch closed, meshes the gears then allows the upper motor brush to drop onto its commutator, completing the starting circuit. At the same time the upper generator brush is lifted from its commutator, breaking the charging circuit while cranking.

SWITCHES:

No.	Switches	Diagrams
70	Nos. 1057 and 1066	882
94	No. 1075	886
115	No. 1075	886
117	Nos. 1103, 1104, 1133, 1158	883
121	No. 1095	884
184	No. 1159	890

DIAGRAMS: See Diagram 822.

DELCO

CADILLAC MOTOR-GENERATORS, THIRD BRUSH REGULATION

NUMBERS: 78, 98.

VOLTAGE: 6.

CHARGE RATE: With hot generator and fully charged battery.

Starts Charge	375-450 R. P. M.
500 R. P. M.	3.0- 8.0 amperes
800 R. P. M.	13.5-17.5 amperes
1100 R. P. M.	16.0-20.0 amperes
1400 R. P. M.	13.0-17.5 amperes
1800 R. P. M.	11.0-16.0 amperes

GENERATOR: Two pole machine with single field coil above armature. Coil contains generator shunt winding and starting series winding.

Single armature with two separate windings; generator commutator at front, motor commutator at rear.

Test Terminals: Ammeter between right hand (4) terminal on generator terminal bracket (looking at front) and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between third brush and second terminal from right (3) on generator terminal bracket (looking from front). Series field between left hand motor brush and large terminal on right side of motor-generator (looking from front).

Single wire system, positive grounded.

REGULATION: Third brush controls field current and output. Third brush mounted above commutator and toward right hand side. Rate is increased by moving brush with armature rotation toward right hand (positive) main brush.

The third brush arm is made in two parts and by loosening the two screws the brush can be moved in either direction.

CUT-OUT: Manual through charging circuit contacts in combination switch, these contacts being connected when the ignition switch is turned on. Circuit is from battery negative to large terminal on one side of motor-generator, to ammeter, to No. 5 terminal on switch, through charging contacts, to No. 6 terminal, to right hand (4) terminal on terminal bracket of motor-generator (looking from front). This circuit allows motoring of the generator while the starter gears are meshed. The discharge continues until the generator is driven at 375-450 R. P. M., after which charging takes place.

STARTER: With the motor-generator idle or charging, both motor brushes are held away from the motor commutator. With the starting switch operated while the generator is motoring, the gears are meshed and the two motor brushes are dropped onto their commutator, completing the cranking circuit. At the same time the generator switch above the right hand motor brush is opened, cutting off the charging circuit from the negative generator brush while cranking.

SWITCHES: Number 78 uses switch No. 1062; number 98 uses switches No. 1077 and No. 1099. See diagram 873.

DIAGRAM: See Diagram 823.

DELCO

HUDSON MOTOR-GENERATORS, THIRD BRUSH REGULATION

NUMBERS: 82, 140, 188.

VOLTAGE: 6.

CHARGE RATE:

Start charge, 0 amperes	450- 500 R. P. M.
3 amperes	525- 600 R. P. M.
7.5 amperes	675- 775 R. P. M.
10.0 amperes	750- 900 R. P. M.
12.5 amperes	900-1125 R. P. M.
14.0-16.0 amperes, maximum	1200-1400 R. P. M.
12.0-14.0 amperes	2000 R. P. M.

GENERATOR: Two pole machine with two field coils, one above the armature and the other below. Each coil contains generator shunt and starter series windings.

Single armature with two separate windings and two commutators. Motor commutator at rear, generator commutator in front. Generator commutator has two main brushes on opposite sides of the commutator with the third brush above and toward the right. Motor commutator has two brushes, one above and one below.

Test Terminals: Ammeter between upper rear terminal on side of motor-generator and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between third brush and upper front terminal on side of motor-generator. Series field between upper motor brush and large lower terminal on side of motor-generator.

Single wire system, negative grounded.

REGULATION: Third brush controls field current and output. Third brush above front generator commutator and toward right. Rate is increased by moving brush with armature rotation toward right hand (negative) main brush.

The third brush arm is made in two parts and by loosening the two screws the brush can be moved in either direction.

CUT-OUT: Manual through charging circuit contacts in combination switch, these contacts being connected when the ignition switch is turned on. This connection allows motoring of the generator while the starter gears are meshed. The discharge continues until the generator is driven at 450-500 R. P. M., when charging commences.

Circuit through switches 1071 and 1106 is from battery positive through cable to large lower terminal on side of motor-generator, to ammeter, through charging contacts in switch, to switch terminal No. 2, to upper rear terminal on side of motor-generator.

Circuit through round switches is from battery positive through cable to large lower terminal on side of motor-generator, to ammeter, to terminal No. 6 on switch 1130 or terminal No. 1 on switch 1188, through charging contacts in switch to terminal No. 5 on switch 1130 or terminal No. 2 on switch 1188, to upper rear terminal on side of motor-generator.

STARTER: With the motor-generator idle or charging, both motor brushes are held away from the motor commutator. Operation of the starter pedal meshes the gears and an extension of the rod allows both motor brushes to drop onto their commutator, thus completing the starting circuit. At the same time, the generator switch above the top motor brush is opened, cutting off the charging circuit from the positive generator brush while cranking.

SWITCHES:

No.	Switches	Diagrams
82	1071, 1106	883
140	1106, 1130	883
188	1188	890

DIAGRAM: See Diagram 824.

DELCO

SEPARATE GENERATOR, THIRD BRUSH REGULATION, SINGLE FIELD COIL

NUMBER: 91.

VOLTAGE: 6.

CHARGE RATE: Higher rates will be found with fully charged battery or with cold generator; lower rates will be found with discharged battery or with hot generator.

Starts charge at	650- 700 R. P. M.
4 amperes at	750- 800 R. P. M.
7 amperes at	840- 925 R. P. M.
10 amperes at	950-1100 R. P. M.
14 amperes at	1175-1400 R. P. M.
16-20 amperes, maximum at	1800-2000 R. P. M.
14-17 amperes at	2500 R. P. M.

GENERATOR: Shunt wound, two pole machine with single field coil above armature. Two main brushes at opposite sides of commutator, third brush below and at left looking at commutator end.

Test Terminals: Ammeter between larger terminal on commutator end and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between third brush and small lead from left hand side of generator to ignition coil. Both ends of shunt field winding brought out on commutator side of coil.

Single wire system, negative grounded.

REGULATION: Third brush controls field current and output. The third brush is carried on a plate screwed to the generator housing below and at the left of the commutator (looking at commutator end).

The screw holes are slotted, and loosening the screw allows the third brush to be moved to the left (nearer negative grounded main brush) to increase the charge rate or to the right (away from nearest brush) to decrease the rate. It is essential that the brush be re-fitted after making an adjustment.

CUT-OUT: Manual through charging contacts on ignition switch plunger. With ignition switch closed the circuit is from positive of battery to starting switch, to ammeter, through charging contacts, to terminal No. 2 on switch, to large terminal on generator. Switches No. 1066 and No. 1067 are used. See diagrams 882 and 883.

A discharge will take place through the generator after the ignition switch is turned on and will continue until the engine is started. No overrunning clutch is fitted.

DIAGRAM: See Diagram 828.

DELCO

SEPARATE GENERATORS, THIRD BRUSH REGULATION, NO CUT-OUT

NUMBERS: With single lead from generator, no separate field lead—84, 87, 89, 99, 101, 103, 108, 114, 123, 125, 131, 133, 134, 135, 137, 138, 153, 156, 163, 167, 220.

With two leads, separate field line—95, 105, 109, 111, 113, 118, 144, 155, 166.

VOLTAGE: 6.

CHARGE RATES: With hot generator and charged battery.

Generator No.	R. P. M. Start Charge	Amperes Output at Revolutions per Minute of				
		600	1000	1400	1800	2000
84	500-525	2.9- 3.8	11.3-13.5	14.0-16.0	12.0-14.0	11.0-13.0
87	490-510	3.0- 4.5	12.5-14.6	16.0-18.0	15.0-17.0	14.0-16.0
89	500-525	2.9- 3.8	11.3-13.5	14.0-16.0	12.0-14.0	11.0-13.0
95	500-525	2.8- 3.6	11.1-13.3	13.8-15.5	12.0-14.0	11.0-13.0
99	500-525	3.0- 4.0	11.5-13.5	14.3-16.0	12.3-14.0	11.0-13.0
101	500-525	2.9- 3.8	11.3-13.5	14.0-16.0	12.0-14.0	11.0-13.0
103	500-525	3.0- 4.0	11.5-13.5	14.3-16.0	12.3-14.0	11.0-13.0
105	500-525	2.9- 3.8	11.3-13.5	14.0-16.0	12.0-14.0	11.0-13.0
108	475-500	3.2- 4.0	12.0-14.0	15.0-17.0	16.0-18.0	14.0-16.0
109	500-525	2.9- 3.8	11.3-13.5	14.0-16.0	12.0-14.0	11.0-13.0
111	500-525	2.8- 3.6	11.1-13.3	13.8-15.5	12.0-14.0	11.0-13.0
113	490-510	3.0- 4.5	12.5-14.6	16.0-18.0	15.0-17.0	14.0-16.0
114	500-525	2.9- 3.8	11.3-13.5	14.0-16.0	12.0-14.0	11.0-13.0
118	500-525	2.9- 3.8	11.3-13.5	14.0-16.0	12.0-14.0	11.0-13.0
123	500-525	2.8- 3.6	11.0-13.0	13.5-15.0	12.0-14.0	11.0-13.0
125	490-510	3.0- 4.5	12.5-14.5	16.0-18.0	15.0-17.0	14.0-16.0
131	500-525	1.3- 1.6	6.0- 7.5	11.0-13.0	15.0-18.0	11.0-16.0
133	550-625	1.0- 2.5	8.5-11.0	12.0-15.5	11.5-15.0	11.0-14.0
134	500-525	2.9- 3.8	11.3-13.5	14.0-16.0	12.0-14.0	11.0-13.0
135	490-510	3.0- 4.5	12.5-14.6	16.0-18.0	15.0-17.0	14.0-16.0
137	490-510	3.0- 4.2	12.5-14.0	16.0-17.5	15.0-16.5	14.0-15.0
138	490-510	3.0- 4.5	12.5-14.6	16.0-18.0	15.0-17.0	14.0-16.0
144	400-450	8.0-10.0	13.0-15.0	10.0-12.0	8.0-10.0	7.0- 9.0
145	400-450	9.5-13.0	16.0-18.0	11.0-16.0	9.0-13.0	8.0-11.5
153	490-510	3.0- 4.5	12.5-14.6	16.0-18.0	15.0-17.0	14.0-16.0
156	900-950	.....	1.0- 3.5	9.0-12.0	11.5-14.7	12.5-15.0
163	500-525	2.9- 3.8	11.3-13.5	14.0-16.0	12.0-14.0	11.0-13.0
166	550-625	1.0- 2.5	8.5-11.0	12.0-15.5	11.5-15.0	11.0-14.0
167	490-510	3.0- 4.5	12.5-14.6	16.0-18.0	15.0-17.0	14.0-16.0
220	550-650	0.0- 1.5	8.0-12.0	12.0-15.5	11.5-15.0	11.0-14.0

GENERATOR: Shunt wound two pole machine with two field coils. Two main brushes opposite each other and third brush below and at right on all except Number 125 which has third brush on left.

Test Terminals: Ammeter between large terminal on generator and wire removed. Voltmeter between this terminal and ground.

Field Terminals: On single terminal, single lead machines, the shunt field is between the third brush and the main generator terminal. On machines having a separate small field lead the shunt field is between the third brush and this small lead.

Single wire system, either positive or negative grounded.

REGULATION: Third brush controls field current and output. Moving the third brush closer to the nearest main brush increases the charge rate, moving it away from the nearest main brush lowers the rate.

The third brush adjustment is reached by removing the band around the end frame. The third brush bracket is in the lower part of the housing and by loosening the two screws in the brush bracket the third brush can be moved in either direction. The maximum charge rate should not exceed 20 amperes under any conditions, 18 amperes being the usual maximum rate.

When adjusting belt driven generators, make sure that the belt does not slip. If the maximum charge rate is not attained until 35-40 miles per hour, in place of 25 miles per hour, it indicates a slipping belt. Belt tension can also be tested by turning on the ignition switch while watching the fan. If the fan moves, even part of a turn, the belt should be tightened.

CUT-OUT: Manual through charging contacts connected to ignition switch as shown in Delco switch diagrams. The circuit is from the ungrounded battery terminal to the starting switch, to the ammeter, to the combination switch, through the charging contacts and to the main terminal on the generator. There is a discharge of 4-7 amperes through the generator after the ignition switch is turned on and before the engine is started.

Some generators are provided with an overrunning clutch which allows the generator to run as a motor with the ignition turned on; others have no clutch.

SWITCHES: The following combinations of generator, switch and motor are used.

DELCO

SEPARATE GENERATORS, THIRD BRUSH REGULATION, NO CUT-OUT—*Continued*

Generator	Motors	Switches	Diagrams	Generator	Motor	Switches	Diagrams
84	85	1066	882	113	72	1066, 1087	882
87	86	1066, 1085	882, 876	114	102	1067	883
87	86	1082, 1093	875	118	110	1086, 1186	882
87	86	1067, 1105	883	118	110	1155	875
89	86	1067	883	123	100	1109	882
95	85, 96, 97	1066	882	125	126	1118	882
99	100	1078	886	131	72	1087	882
101	102	1067, 1105	883	133	130	1130	890
101	102	1066, 1081	882	134	72	1104	882
101	102	1104, 1113	882	135	136	1067, 1090	883
101	102	1069	873	135	136	1104, 1105	882, 883
103	104	1067, 1105	883	135	136	1142, 1147	875
103	104	1164	881	135	136	1079	874
105	106	1066, 1081	882	137	72	1104, 1146	882
105	106	1090, 1105	883	138	72	1107, 1132	882, 875
105	106	1104, 1147	882	153	72	1154	875
105	106	1143, 1145	883	156	157	1126	887
105	106	1149, 1152	883	163	97	1104	882
105	106	1078, 1172	886	166	161	1130, 1177	890
105	107	1075	886	166	161	1188	890
109	110	1086	882	220	219	1198	890
111	100	1066, 1078	882, 886				

DIAGRAMS: See Diagrams 825, 826, 827, 830, 834.

DELCO

SEPARATE GENERATORS, TWO POLE, THIRD BRUSH REGULATION, CUT-OUT ON TOP

NUMBERS: 165, 169, 176, 180, 195, 197, 199, 204, 210, 227.

VOLTAGE: 6.

CHARGE RATES: With hot generator and fully charged battery.
For generators 165 and 169.

Cut in	550-650 R. P. M.
800 R. P. M	4.0- 7.0 amperes
1200 R. P. M	11.0-14.5 amperes
1600 R. P. M	12.0-16.0 amperes
2000 R. P. M	11.0-14.0 amperes

For other generators—

Cut in	750-800 R. P. M.
900 R. P. M	4.8- 7.8 amperes
1200 R. P. M	11.0-15.0 amperes
1500 R. P. M	12.5-16.0 amperes
2000 R. P. M	8.0-12.0 amperes

GENERATOR: Shunt wound, two pole machine, with two field coils. Two main brushes opposite each other, with third brush below and at right.

Test Terminals: Ammeter between terminal on end of cut-out, from which lead runs to main brush, and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between third brush and lead running to terminal on end of cut-out.

Single wire system, positive or negative grounded.

For those generators having the flexible bronze spring brush arms, see instructions for fitting in following section 727.

REGULATION: Third brush controls field current and output. Moving the third brush with the direction of armature rotation, closer to nearest main brush, increases the output. Moving it against armature rotation decreases the output.

The brush is moved by moving a plate on the end of the generator. The plate can be moved within certain limits after loosening three adjusting screws. An arrow on the plate through which the screws pass indicates the direction of movement for increasing the rate. Some generators have an adjustment similar to that described in the preceding section 724.

When adjusting generators that are belt driven, make sure that the belt does not slip. If maximum rate does not come until the car is driven at 35-40 miles per hour, instead of at about 25 miles per hour, it indicates a slipping belt.

CUT-OUT: Magnetic, mounted on the generator housing.
Closes at 7.0-8.0 volts, opens with discharge of 0.0 to 3.0 amperes.

Gap between contacts when open to be .046-.062 in. Gap between end of magnet core and armature to be .025-.035 in. with contacts closed. Gap adjusted by bending the brass stop on the front of the cut-out, above the spring and at the contact end.

Spring tension adjusted by tightening or loosening the spring adjusting nut at the left hand end of the spring.

Should the end of the blade carrying the moving contact rub inside the cut-out cover, grind or file the end of the blade to within $\frac{1}{64}$ in. of the contact.

Silver contacts are used.

SWITCHES: The following combinations of generators, starting motors, and combination switches are used:

Generators	Motors	Switches	Generators	Motors	Switches
165	164	1145, 1147	195	194	1185
165	164	1149, 1152	197	200	1189
165	164	1153, 1160	199	181	1189
165	164	1166, 1174	210	209	1203
169	170	1161	227	226	1211
176	177	1166, 1172			
180	179	1157, 1167			
180	179	1172, 1178			
180	179	1180, 1181			

DIAGRAM: See Diagram 831.

DELCO

SEPARATE GENERATORS, FOUR POLE, THIRD BRUSH REGULATION, CUT-OUT ON TOP

NUMBERS: 168, 182, 186, 203, 206.

VOLTAGE: 6.

CHARGE RATES: With hot generator and fully charged battery.

Number	168, 203	182, 186, 206
Cut in, R. P. M.	290 R. P. M.	750-800 R. P. M.
Amps at 400 R P. M.	6.5	
Amps at 800 R.P. M.	13.5	0.0- 3.5
Amps at 1000 R.P. M.	14.0	8.0-11.0
Amps at 1400 R. P. M.	12.5	12.3-16.0
Amps at 2000 R. P. M.	10.0	8.0-12.0

GENERATOR: Shunt wound, four pole machine with four field coils. Two main brushes; ungrounded brush on top, grounded brush at right hand side. Third brush on 168 is just below grounded main brush. On others the third brush is at the left hand side.

Test Terminals: Ammeter between terminal on end of cut-out, from which leads run to ungrounded brush, and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between third brush and lead running to terminal on end of cut-out.

Single wire system, positive or negative grounded.

Some of the generators are fitted with flexible brush arms using a thin strip of phosphor bronze between the brush and the body of the arm. An insulating safety plate is mounted by special heads on the screws fastening the brush to the arm; this avoids danger of damaged commutators should a brush break. To fit this type of brush, it is necessary to place wedges about .075″ thick between the brush arm body and the strip of bronze in order to secure temporary rigidity. The work may also be done by removing the end head, wrapping fine sandpaper once or twice around the commutator and gluing the ends, replacing the head (without wedges under brush arms) and rotating armature.

REGULATION: Same as preceding section 726.

CUT-OUT: Same as preceding section 726, except that spring tension is adjusted by slightly bending the lug carrying the end of the spring toward the contact end.

SWITCHES: The following combinations of generators, starting motors and combination switches are used:

Generator	Motor	Switches	Diagram	Generator	Motor	Switches	Diagram
168	172	1163	892	186	185	1184	891
182	183	1173	892	206	172	1194	895

DIAGRAMS: See Diagram 835.

DELCO

SEPARATE GENERATORS, CONSTANT VOLTAGE REGULATION:

NUMBERS: 192, 201, 225.

VOLTAGE: 6 volts for 192 and 201. 12 volts for 225.

CHARGE RATES: With battery S.G. below 1.250, generator operating as a straight third brush machine, the charge rates are the same on the six volt types (192, 201) as given in the preceding section. For the twelve volt machine (225) the amperage is about one-half the values given.

With the battery S.G. at 1.250 or above, the voltage regulator operates to reduce the charge rate in proportion to the battery's state of charge and counter-voltage.

GENERATOR: Generators 201 and 225 are shunt wound machines with two field coils. The two main brushes are opposite each other and the third brush is below and at the right.

Generator 192 is a shunt wound machine with four field coils. The ungrounded main brush is on top of the commutator and the grounded main brush at the right hand side of the commutator. The third brush is at the left hand side of the commutator.

Test Terminals: Ammeter between generator terminal A, from which line runs to regulator terminal A, and the wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between third brush and generator terminal F, from which line runs to regulator terminal F.

REGULATION: Third brush controls field current and output with battery S.G. at 1.250 or below. Moving the third brush with direction of armature rotation increases the charge rate, moving it against armature rotation decreases the rate.

A vibrating voltage regulator is carried in the apparatus box with the cut-out and this regulator acts in conjunction with the third brush control. Until the battery reaches a state of full charge the current forced through the voltage coil of the regulator is not sufficient to cause it to act. There are three windings on the magnet. The voltage coil winding consists of many turns of fine wire and is connected across the generator at all times. Another coil consists of a large number of turns of fine wire wound in the opposite direction to the voltage coil. The third is a non-inductive winding with half its turns wound in each direction. The reverse and the non-inductive windings are connected across the contacts and from a field circuit resistance with the contacts opened by the voltage coil. The non-inductive winding prevents sparking at the contacts.

The voltage regulator is adjusted with the battery fully charged or entirely disconnected from the system. The maximum voltage with the generator in action should be 7.75 volts on 192 and 201, and 15.0 volts on 225, at all usual engine speeds. Increasing the spring tension by means of the adjusting nut will raise the voltage, while decreasing the spring tension will lower the voltage.

CUT-OUT: Same as preceding section, except that the voltage at cut-in is 6.25-6.5 volts on 192 and 201, and is 12.5-13.0 volts on 225.

SWITCHES: Number 192 generator uses 179 motor and 1181 combination switch.

Number 201 generator uses 202 motor and 1185 combination switch.

Number 225 generator uses 224 motor and 1126 combination switch.

See Diagrams 891, 894, and 877.

DIAGRAM: See Diagram 833.

DELCO

MOTOR-GENERATOR, ROUND FRAME, THIRD BRUSH REGULATION.

NUMBERS: 162, 187, 193, 207.

VOLTAGE: 6.

CHARGE RATE: High charge rates occur with a fully charged battery or a cold generator. With a hot generator the rate is lowered by a thermostat.

Start charge at	350 R. P. M.
4.0- 5.0 amperes at	375- 400 R. P. M.
8.0- 9.5 amperes at	430- 450 R. P. M.
13.0-14.0 amperes at	650- 850 R. P. M.
15.0-16.0 amperes at	1300-1700 R. P. M.
14.0-15.0 amperes at	2000 R. P. M.

GENERATOR: Motor generator frame carries four pole pieces. Two opposite sides carry shunt field windings for generator action and operate as four pole machine with two wound poles and two consequent poles. Other two pole pieces carry motor field windings.

Single armature with two separate windings and two commutators. Generator commutator at front end, motor commutator at drive end.

Two main generator brushes, one at top of commutator and one at right hand side. Third brush on left hand side below center line.

Test Terminals: Ammeter between small terminal nearest end of housing and wire removed from this terminal. Voltmeter between this terminal and ground.

Field Terminals: Shunt field (generator) between third brush and small terminal farthest from end of housing (F).

REGULATION: Third brush controls field current and output. Third brush on left hand side of generator commutator and below center line. Moving the third brush in the direction of armature rotation, clockwise looking from generator end, increases the charge rate; moving this brush in the opposite direction lowers the charge rate.

The adjustment is reached by first removing the cover band over the generator brushes, then loosening the adjustment clamp nut on the front end of the generator housing one or two turns. The adjusting screw operating the third brush plate can then be turned to the right (clockwise) to increase the charge rate or to the left to decrease the rate. The clamping nut must be tightened after making an adjustment.

THERMOSTAT: On motor-generators 162, 187 and 207 a thermostat is mounted on the third brush arm. The thermal blade carrying one of the contacts is made from brass, welded to nickel steel and this blade warps when the temperature reaches 195-200° F. The contacts carry the field current and between them is a resistance through which the field current is forced to flow after they open. With the generator at this temperature and the contacts opened, the resistance in the field circuit causes a drop in the charge rate of about 50 per cent.

CUT-OUT: Manual through charging contacts in the combination switch which are closed when the ignition is turned on.

On motor-generators 162, 187 and 193 the circuit is from the battery through the ammeter to No. 5 switch terminal, through the charging contacts to No. 6 switch terminal, to the small terminal (A) nearest the end of the motor-generator.

On motor-generator 207 the charging contacts are between switch terminals No.1 and No. 2.

The discharge allowed through this circuit after the ignition switch is closed and before the engine is started causes the generator to run as a motor, making a clicking sound due to the overrunning clutch.

STARTER: Two opposite pole pieces carry the starting motor series field windings, the machine operating as a four pole motor with two wound poles and two consequent poles. The motor commutator is at the drive end of the single armature.

There are four brushes, the upper one and the lower one being grounded. One field coil is connected between one of the side brushes and the motor terminal, while the other field coil is connected between the opposite motor brush and the motor terminal on the housing. The two series field coils are thus in parallel with each other.

The brushes act as a starting switch. They are lifted from the motor commutator when the machine is at rest or generating; the lifting being accomplished through a rotating brush lifting plate having four extended arms which strike rollers on each of the four pivoted brush arms. After the gears are meshed, further movement of the starter pedal rotates this plate and drops the brushes onto the commutator.

The charging circuit between the top generator brush and the small terminal nearest the front of the housing is completed through a contact blade and contact carried above the top motor brush. The contact is attached to the brush arm. When the brush is lowered for starting, the charging circuit is opened as these contacts separate.

SWITCHES: Motor-generator 162 uses switch No. 1150; number 187 uses switch No. 1183; number 193 uses switch No. 1187, and number 207 uses switch No. 1204. See Diagrams 873, 893 and 890.

DIAGRAMS: See Diagram 837.

DETROIT WARD LEONARD

MOTOR GENERATOR

TYPE: RS.

VOLTAGE: 6.

CHARGE RATE:

Cuts in	1350 R. P. M.
3.0 amperes	1500 R. P. M.
7.5 amperes	1700 R. P. M.
12.0 amperes, maximum	1900 R. P. M. and over

MOTOR-GENERATOR: Four pole machine; two field coils, one above and one below the armature, each coil containing shunt and series windings.

Four brushes, negatives on top and bottom, positives on opposite sides.

Single armature, one winding and one commutator.

Test Terminals: Ammeter between upper terminal on side of motor-generator and wire removed (engine to be cranked by hand as this connection carries starting current). Voltmeter between upper and lower terminals on side of motor-generator.

Field Terminals: Shunt field windings between center terminal on side of motor generator and lower terminal. Upper series field between upper terminal on side of motor-generator and positive brushes lower field between lower terminal and negative brushes.

Field Current: 10 amperes on 6 volt battery.

REGULATION: Constant amperage maintained above rated speed by Ward Leonard vibrating regulator.

Regulator contacts are below and at the right and connected between them is the field resistance carried on top of the regulator. This resistance is in series with the shunt field and is shorted out while the regulator contacts are closed. Contacts and resistance are between terminals B and C.

The charge rate is increased by increasing the spring tension of the spring that holds the regulator contacts closed and the rate is lowered by lessening the tension of this spring. The tension is changed by bending the support for the upper end of this (outer) spring.

CUT-OUT: Magnetic, combined in single unit with regulator and mounted separately from the motor-generator.

Closes at 1350 R.P.M., 6.5-7.5 volts; opens with discharge of 1.0-2.0 amperes.

Closing speed and voltage increased by increasing tension of the inner spring which holds cut-out contacts (at top) open. Opening discharge is lessened by increasing the tension of this spring.

Spring tension is altered by bending the support for the lower end of the spring.

STARTER:

Speed	Amperes	Ft.-Lbs. Torque	Volts
Locked	300	12.0	3.9
500 R. P. M.	215	7.8	4.5
1000 R. P. M.	125	3.4	5.1
1500 R. P. M.	80	1.4	5.5
2000 R. P. M.	45	0.5	6.0

DIAGRAMS: See Diagrams 926 and 927.

DETROIT WARD LEONARD

SEPARATE UNIT SYSTEM

TYPES: AG Generator, AM Motor.

VOLTAGE: 6.

CHARGE RATE:

Starts charge, cuts in.....550–600 R. P. M.
Maximum, 10.0 amperes at.....850–900 R. P. M. and above

GENERATOR: Two-pole shunt wound machine with two field coils, one above and ane below the armature. Two main brushes on opposite sides of commutator.

Test Terminals: Ammeter between either the A or B (either outside) terminal of the generator and the wire removed. Voltmeter between the A and B (two outside) terminals of the generator.

Field Terminals: Shunt field coils in series between the A (right hand) generator terminal and the F (center) terminal.

REGULATION: Constant amperage maintained at speeds above 850-900 R. P. M. by Ward Leonard vibrating regulator, Type C.C

Regulator contacts are below and at the right with the field resistance unit mounted next the magnet coil and connected between the contacts. The contacts and resistance are in series with the generator shunt field circuit between regulator terminals B and C.

The charge rate is increased by increasing the tension of the outside spring by bending the bracket holding the upper end of this spring. Lessening the spring tension lowers the rate. Altering the regulator spring has no effect on the cutting in speed.

CUT-OUTS: Magnetic combined in single unit with regulator.

Closes at 6.5-7.5 volts, 550-600 R. P. M. Opens with discharge of 0.0-3.0 amperes.

Contacts are at the top on the right hand side. The inside spring is for the cut-out and its tension is increased by bending the bracket holding the lower end of the spring. The armature and contact gaps are changed by bending the stop below the movable cut-out contact.

STARTER: Two-pole series wound motor with one field coil connected between one of the motor terminals and the right hand brush, while the other field coil is connected between the left hand brush and the other motor terminal.

DIAGRAM: See Diagram 928.

DISCO

SEPARATE UNITS OR DOUBLE DECK, REVERSED SERIES REGULATION

MODELS: 3-E, 5-E, 10-S.

VOLTAGE: 6 volts for 10-S, 12 volts for 3-E and 5-E.

CHARGE RATES:

R. P. M.	Model 3-E	Model 5-E	Model 10-S
350	cuts in		
400	5.5 amps	cuts in	
450	6.2 amps	4.6 amps	cuts in
500	6.7 amps	5.0 amps	2.0 amps
600	7.0 amps	5.1 amps	5.0 amps
1000	7.2 amps	5.3 amps	12.5 amps
1250	7.5 amps	5.5 amps	14.5 amps
2000	8.0 amps	6.0 amps	15.0 amps

GENERATOR: Two pole, shunt wound machine with reversed series winding in addition to shunt. Two field coils, one above and one below armature.

Two brushes set opposite each other.

Test Terminals: Ammeter between either generator terminal and wire removed. Voltmeter between two terminals on generator. In double deck machine, generator is upper unit.

REGULATION: Reverse series field winding limits output. No adjustment provided.

CUT-OUT: Magnetic, mounted as separate unit.

Closes at 6.5-7.5 volts; 350 R.P.M. on Model 3-E, 400 R.P.M. on Model 5-E, 450-500 R.P.M. on Model 10-S.

Opens with discharge of 1.0-2.0 amperes.

Cut-out has double contacts, one set carbon and the other set copper. The copper contacts are farther apart than the carbon pair so that the carbons close first and open last, thus taking any spark that may occur at opening. Gap of copper contacts adjusted by bending the stationary (leaf) points, making sure that both sides operate at the same instant.

DIAGRAM: See Diagram 976.

DISCO

MOTOR-GENERATOR, 12-VOLT

TYPES: 24, 26, 28 and 29.

VOLTAGE: 12.

CHARGE RATE:

Output	Models 24, 26	Models 28, 29
Cuts in	1250 R. P. M.	1300 R. P. M.
3.0 amperes	1450 R. P. M.	1550 R. P. M.
7.0 amperes	1780 R. P. M.	1850 R. P. M.
10.0 amperes	2000 R. P. M.	2150 R. P. M.

GENERATOR: Four pole machine with two field coils, one above and one below armature. Each coil contains shunt and series winding.

Two brushes set at 90 degrees from each other, one on top of commutator, other at side. Single armature with one winding for both functions.

Test Terminals: Ammeter between small wire removed from large terminal on motor-generator (leading to controller terminal B) and this terminal. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between large and small terminals (ungrounded) on motor-generator. Series field (and armature) between two large terminals (one grounded).

REGULATION: Constant amperage maintained above highest speed given under **Charge Rate.** Uses Ward Leonard vibrating regulator, Type CD.

Field resistance carried outside of regulator is in series with shunt field circuit and is short circuited by the two pairs of (lower) regulator contacts when they are closed.

The regulator contacts are held closed by a coil spring. Increasing the tension on this spring increases the maximum charge rate, lessening the tension lowers the maximum rate. The rate is approximately constant at speeds above the rated maximum.

CUT-OUT: Magnetic, combined with regulator. Cut-out contacts are at the top of the unit on the right hand side, above the regulator contacts.

Closed at 13.0-14.0 volts; opens with discharge at 0.1-1.5 amperes.

The contacts are held open by a small coiled spring. Increasing the tension of this spring by bending its support will raise the voltage and speed of closing; lessening the tension will decrease the amperage for opening.

STARTER:

Speed	Models 24, 26			Models 28, 29		
	Ft.-Lbs.	Amps.	Volts	Ft.-Lbs.	Amps.	Volts
Locked	38	350	8.9	23	218	8.8
300 R. P. M.	24	220	10.4	14	140	10.0
600 R. P. M.	9	95	10.8	5	70	11.0
900 R. P. M.	free	20	11.8	1	27	11.6
1000 R. P. M.				free	14	11.8

DIAGRAM: See Diagram 978.

DISCO

SEPARATE UNITS, CONSTANT CURRENT, VOLTAGE CONTROL.

MODELS: 100 Generator, 200 Motor.

VOLTAGE: 6.

CHARGE RATE: With a battery charged, Sp.Gr. 1.280 to 1.300, the maximum rate is 6 amperes, reached at 575 R.P.M. and maintained constant at high speeds.

With battery discharged, Sp.Gr. 1.150 to 1.200, the maximum rate is 11 amperes, reached at 675 R.P.M. and maintained constant at higher speeds.

In either case the charge rate is 2.0 amperes at 485 R.P.M., 4.0 amperes at 525 R.P.M.

GENERATOR: Four pole shunt wound machine with four field coils. Two brushes set at 90 degrees from each other.

Test Terminals: Ammeter between terminal on regulator cut-out and outside wire removed. Voltmeter between this terminal and ground.

Single wire system, negative grounded.

REGULATION: Constant current maintained above rated speed by vibrating type of regulator having voltage control which allows 5 amperes more charge with discharged battery than with fully charged battery.

Maximum with charged battery, 6 amperes; with discharged battery, 11 amperes; intermediate rates according to battery condition.

Charge rate increased by increasing tension of spring holding regulator contacts together.

CUT-OUT: Magnetic, in single unit with regulator and mounted on top of generator.

Closes at 6.5-7.0 volts, 450-475 R.P.M. 1.0-1.5 amperes.

Opens with discharge of 1.0-2.0 amperes.

Closing voltage and speed increased by increasing tension of spring which holds cut-out contacts apart. Discharge amperage for opening lowered by decreasing the spring tension.

STARTER:

Revolutions per Minute	Ft.-Lb. Torque	Amperes	Volts
Locked	16.0	470	3.6
400	9.6	320	4.4
800	5.2	210	5.0
1500	1.7	105	5.5
2000	0.9	75	5.7
3700	free	30	5.9

DIAGRAM: See Diagram 984.

DYNETO

ENTZ, 18 VOLT MOTOR-GENERATOR.

VOLTAGE: 18 for charging and starting. Head lamps, two in series on 12 volts; other lamps 6 volts.

CHARGE RATE:

Starts charge	1000 R. P. M.
5.0 amperes	1400 R. P. M.
10.0 amperes	2200 R. P. M.
13.0 amperes, maximum	3500 R. P. M.

MOTOR-GENERATOR: Four pole machine with shunt and series winding. Two field coils, one above and one below armature, each containing generator shunt winding and starter series winding.

Four brushes equally spaced around commutator, opposite pairs joined. Single armature with one winding and one commutator for both starting and charging.

Test Terminals: Ammeter between either the N or P terminal (front terminals) on top of motor-generator and wire removed. This connection carries the starting current also, so engine should be cranked by hand. Voltmeter between terminal N (front left hand) and terminal A (second from front on left).

REGULATION: Starter series field windings act as reversed series fields while generating to limit output. No adjustment provided.

CUT-OUT: Manual through starting switch. Switch has three positions, "Off," "Neutral" and "On." In the "Off" position, the magneto is grounded and the battery disconnected from the motor-generator. In the "Neutral" position the magneto ground is removed, but the generator shunt field circuit is open and there is no charge. In the "On" position the battery is connected to the motor-generator and the shunt field circuit is closed for generating.

DIAGRAM: See Diagram 1059.

DYNETO

MOTOR-GENERATOR, REVERSED SERIES REGULATION.

SIZE: B.

VOLTAGE: 12.

CHARGE RATE:

Starts charge	1100 R. P. M.	12.5 volts
2.5 amperes	1200 R. P. M.	12.7 volts
5.0 amperes	1400 R. P. M.	13.2 volts
7.0 amperes	1500 R. P. M.	13.7 volts
10.0 amperes	1700 R. P. M.	14.2 volts

MOTOR-GENERATOR: Six pole machine with generator shunt windings on three alternate poles and series windings on three intermediate poles.

Two main brushes set near top of commutator and at 60 degrees from each other. Single armature and single commutator.

Test Terminals: Ammeter between terminal 1 (right hand at commutator end) and cable removed (engine to be cranked by hand as this connection carries starting current). Voltmeter between terminals 1 and 2 (right and left hand terminals at commutator end).

Field Terminals: Shunt field winding between terminal 1 (right hand at commutator end) and terminal 3 (right hand from drive end). Series winding between left hand main brush and terminal 2 (left hand at commutator end).

REGULATION: Series fields oppose shunt fields while generating. No adjustment provided.

CUT-OUT: Manual, through action of starting switch.

Switch has three positions, "Off," "Neutral" or "Touring" and "Start." In the "Off" position the charging and starting circuits are opened. In the "Start" position these circuits are closed, the motor-generator cranks the engine and maintains a charge as long as the motor-generator speed is above 1100 R.P.M. Below this speed there is a discharge of from 0-15 amperes with speed decreasing from 1100 to 800 R.P.M. At still lower speeds the motor-generator acts as a motor and cranks the engine. In the "Neutral" or "Touring" position the shunt field circuit is opened from terminal 3 and there is no charge.

STARTER: Machine acts as a compound wound starting motor.

6 Ft.-Lb. torque at 400 R. P. M.	50 amperes	11.6 volts
10 Ft.-Lb. torque at 300 R. P. M.	65 amperes	11.4 volts
20 Ft.-Lb. torque at 180 R. P. M.	117 amperes	10.7 volts
30 Ft.-Lb. torque at 80 R. P. M.	160 amperes	10.1 volts
40 Ft.-Lb. torque when locked	210 amperes	9.5 volts

DIAGRAM: See Diagram 1051.

DYNETO

MOTOR-GENERATOR, THIRD BRUSH REGULATION.

SIZES: A and B.

VOLTAGE: 12.

CHARGE RATES:

R. P. M.	Size A		Size B	
900			starts charge	
1000	starts charge		2.0 amps	14.9 volts
1200	5.0 amps	15.2 volts	6.2 amps	15.7 volts
1500	9.0 amps	16.0 volts	10.6 amps	16.8 volts
1800	11.0 amps	16.7 volts	13.3 amps	17.6 volts
2000	11.5 amps	17.0 volts	14.3 amps	17.8 volts
2500	10.3 amps	16.7 volts	15.0 amps	17.3 volts
3000	8.3 amps	16.3 volts	14.4 amps	17.0 volts

MOTOR-GENERATOR: Six pole machine. Size A has generator shunt windings on three alternate poles with series winding on intermediate poles. Size B has shunt and series windings on each of six poles.

Two main brushes near top of commutator and set at 60 degrees from each other. Third brush between main brushes.

Test Terminals: Ammeter between terminal 1 (right hand on commutator end) and cable removed (engine to be cranked by hand as this connection carries starting current). Voltmeter between terminals 1 and 2 (right and left hand on commutator) end.

Field Terminals: Shunt field between terminal 3 (right hand at drive end) and third brush. Series field between left hand main brush and terminal 1 (right hand from commutator end).

REGULATION: Third brush controls field current and output. Moving this brush with the direction of armature rotation increases the output rate, moving it against armature rotation lowers the rate.

The third brush holder is held in place by two screws, loosening which allows the brush to be moved either way.

CUT-OUT: Manual with starting switch, same as for preceding Section 1003.

STARTER: Machine operates as a compound starting motor.

Ft.-Lbs. Torque	Size A			Size B		
	R. P. M.	Amperes	Volts	R. P. M.	Amperes	Volts
5	430	30	11.9	445	35	11.9
10	305	56	11.5	310	63	11.6
15	210	82	11.0	240	90	11.2
20	130	107	10.5	175	116	10.8
25	60	132	10.0	120	141	10.5
30	locked	160	9.4	75	165	10.2
35				30	187	9.8
40				locked	212	9.5

DIAGRAMS: See Diagrams 1052 and 1053.

DYNETO

MOTOR-GENERATOR, THIRD BRUSH REGULATION, ROUND FRAME.

MODELS: KR, K1R, K4R, etc.

VOLTAGE: 12.

CHARGE RATE:

Start Charge	850 R. P. M.	12.5 volts
5.0 amperes	1000 R. P. M.	13.5 volts
9.4 amperes	1200 R. P. M.	14.7 volts
11.8 amperes	1500 R. P. M.	16.4 volts
12.2 amperes	1700 R. P. M.	17.0 volts
11.3 amperes	2000 R. P. M.	16.7 volts
9.2 amperes	3000 R. P. M.	16.0 volts

MOTOR-GENERATOR: Four pole machine with shunt coil and series coil on each pole.

Two main brushes on upper side of commutator and set at 90 degrees from each other. Third brush between the main brushes.

Three terminals in line on top of housing, numbered 2, 3, 1 from commutator end to drive end.

Test terminals: Ammeter between terminal 2 and cable removed (engine to be cranked by hand as this connection carries the starting current). Voltmeter between terminals 1 and 2.

Field Terminals: Shunt field winding between third brush and terminal 3. Series field winding; two coils between right hand main brush and terminal 2, other two coils between left hand main brush and terminal 1.

REGULATION: Third brush controls field current and output. Moving this brush with the direction of armature rotation (to the left looking at the commutator end) increases the output rate, moving it against armature rotation lowers the rate.

The third brush holder is held in place by two screws. Loosening the screws allows the brush and holder to be moved either direction.

CUT-OUT: Manual with starting switch, same as preceding Section 1003.

STARTER: Machine operates as a compound wound starting motor.

5 Ft.-Lb. torque at 32 amperes	475 R. P. M.	12.0 volts
10 Ft.-Lb. torque at 59 amperes	350 R. P. M.	11.6 volts
20 Ft.-Lb. torque at 112 amperes	200 R. P. M.	11.0 volts
30 Ft.-Lb. torque at 167 amperes	80 R. P. M.	10.2 volts
40 Ft.-Lb. torque at 220 amperes	locked	9.5 volts

DIAGRAM: See Diagram 1054.

DYNETO

SEPARATE UNITS, CONSTANT AMPERAGE REGULATION.

TYPES: VA generator, UA motor.

VOLTAGE: 6.

CHARGE RATE:

Cuts in at	500-550 R. P. M.	10.0 amperes	850 R. P. M.
2.0 amperes	610 R. P. M.	11.2 amperes	1000 R. P. M.
4.0 amperes	680 R. P. M.	10.5 amperes	2000 R. P. M.
7.5 amperes	780 R. P. M.	9.5 amperes	3000 R. P. M.

GENERATOR: Four pole shunt wound machine. Upper and lower field coils with side poles consequent.

Two main brushes on upper side of commutator, set at 90 degrees from each other. Positive brush on left, negative on right, looking at commutator end.

As originally built, this machine used three terminals on the top of the housing, marked P, F, N, from left to right. Terminal P is connected to the left hand positive brush. The shunt field coils are connected between terminals F and N. Terminal N is connected to the right hand negative brush as well as to the field coil.

Many of these machines have been rebuilt to do away with the top terminals P and N, substituting for these terminals new ones formed on the brush holder studs and appearing through the front of the commutator end. With the rewired generator the shunt field remains connected between terminal F and the stud on the right hand side of the top of the housing that formerly was the N terminal, this stud being grounded and grounding the field. The stud for the positive brush forms terminal P, while the stud for the negative brush is grounded.

Test Terminals: Ammeter between terminal P and the wire removed. Voltmeter between terminals P and N, or between terminal P and ground.

Field Terminals: Shunt field between terminal F and the right hand terminal or stud on top of the generator.

REGULATION: Vibrating type of regulator controls resistance in the shunt field circuit and limits charge rate above speed for which the regulator is set. Regulator and cut-out are combined in one unit but separate from the generator.

Regulator contacts are normally held closed by flat spring. In parallel with the points is an external resistance coil in series with the shunt field circuit. With points open, this resistance is in the field circuit, with them closed the resistance is shorted out of the field circuit.

Charge rate is increased by increasing the spring tension or reducing the armature air gap; the rate is lowered by lessening the spring tension or increasing the armature air gap.

Spring tension is changed by bending the lip attached to the armature. Gap is changed by bending the stationary contact support.

CUT-OUT: Magnetic, combined with regulator.

Closes at 500-550 R.P.M., 6.5-7.5 volts; opens with discharge of 0.5-2.0 amperes.

Earlier closing secured by lessening armature air gap, later closing by increasing air gap. Gap adjusted by bending arm that limits opening of contacts.

Earlier (lower discharge) opening secured by lessening spring tension, later opening (higher discharge) secured by increasing spring tension. Spring tension altered by bending the lip attached to the cut-out armature and holding the free end of the spring.

STARTER: Four pole machine with two poles carrying series field coils and two consequent poles on either side. One series coil between one terminal on housing and one brush, other coil between remaining terminal and brush. Two brushes set at 90 degrees with each other.

1 Ft.-Lb. torque at 100 amperes	1920 R. P. M.	5.4 volts
3 Ft.-Lb. torque at 190 amperes	1100 R. P. M.	5.1 volts
5 Ft.-Lb. torque at 280 amperes	610 R. P. M.	4.7 volts
7 Ft.-Lb. torque at 380 amperes	280 R. P. M.	4.4 volts
9.5 Ft.-Lb. torque at 485 amperes	locked	4.0 volts

DIAGRAM: See Diagram 1055.

DYNETO

SEPARATE UNITS, THIRD BRUSH REGULATION

TYPES: CA generator, DA motor.

VOLTAGE: 6.

CHARGE RATE: The higher rates will be obtained with a cold generator or with a charged battery; lower rates with a hot generator or a discharged battery.

450-500 R. P. M.	cuts-in	1250 R. P. M.	11.5-12.5 amps.
700 R. P. M.	5.0- 6.0 amps.	1500 R. P. M.	12.4-14.0 amps.
900 R. P. M.	8.5- 9.5 amps.	2000 R. P. M.	9.1- 9.5 amps.
1100 R. P. M.	10.8-11.9 amps.	2500 R. P. M.	8.0 amps.

GENERATOR: Four pole shunt wound machine with field coil on each pole.

Two main brushes at 90 degrees from each other, both on lower side of commutator. Positive brush at left, negative (grounded) brush at right. Third brush on upper side of commutator and toward left.

Test Terminals: Ammeter between terminal on commutator end of housing at left and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between third brush and strap connection to positive terminal on end of commutator housing.

The three brushes are mounted on a rocker arm held to the frame by four screws. To reach the brushes, loosen the pigtail attached to the third (upper) brush, loosen the four screws and rotate the brush ring to bring the brushes in front of the opening through the housing.

REGULATION: Third brush controls field current and output. Moving the brush with armature rotation will increase the output, moving it the opposite direction lowers the output.

The third brush contact may be shifted (when not provided with adjustment) by filing off the left hand side of the contact end to move it to the right, filing off the right hand side to move the contact surface to the left. File only a very little at a time, then replace brush and test charge rate.

On generators fitted with the sliding type of third brush holder, remove the leather plug in the commutator end of the housing, release the screw exposed by this removal and move brush in direction of armature rotation to increase output, against rotation to lower output.

CUT-OUT: Magnetic, mounted on top of generator or as a separate unit.

Closes at 450-500 R.P.M., 6.5-7.5 volts; opens with discharge of 0.5-2.0 amperes.

Closing voltage is lowered by lessening the armature air gap by moving the stationary contact; opening discharge is lessened by increasing spring tension by bending the lip attached to the armature and resting on the spring.

STARTER: Four pole machine with series field coils on each of the four poles. Two brushes placed at 90 degrees from each other. Two coils connected between one brush and one terminal.

Running light at	30- 35 amperes	5000 R. P. M.	6.0 volts
1 Ft.-Lb. torque at	90 amperes	2250 R. P. M.	5.5 volts
2 Ft.-Lb. torque at	118 amperes	1800 R. P. M.	5.3 volts
4 Ft.-Lb. torque at	175 amperes	1250 R. P. M.	5.1 volts
6 Ft.-Lb. torque at	230-235 amperes	850 R. P. M.	4.9 volts
8 Ft.-Lb. torque at	285-295 amperes	550 R. P. M.	4.7 volts
10 Ft.-Lb. torque at	345-355 amperes	300 R. P. M.	4.5 volts
12 Ft.-Lb. torque at	400 amperes	*locked	4.2 volts
14 Ft.-Lb. torque at	460 amperes	*locked	4.2 volts

*12 Ft.-Lb. lock torque on standard motor, 14 Ft.-Lb. lock torque on heavy duty motor.

DIAGRAM: See Diagram 1057.

ELECTRO

MOTOR-GENERATOR

VOLTAGE: 6 for charging and lighting, 24 for starting.

CHARGE RATE:

Cuts in, starts charge	1100 R. P. M.
15.0 amperes	2300 R. P. M.
30.0 amperes	3300 R. P. M.

MOTOR-GENERATOR: Shunt and series windings on two poles. Single armature and commutator for both starting and charging.

Test Terminals: Ammeter between terminal A on motor-generator and wire removed. Engine to be cranked by hand as this connection carries the starting current. Voltmeter between terminals S and A on motor-generator.

Field Terminals: Shunt field winding between motor-generator terminals A and F. Series field winding between motor-generator terminals A and S.

REGULATION: Current increases with speed from cut in point to maximum of about 30 amperes. No adjustment provided.

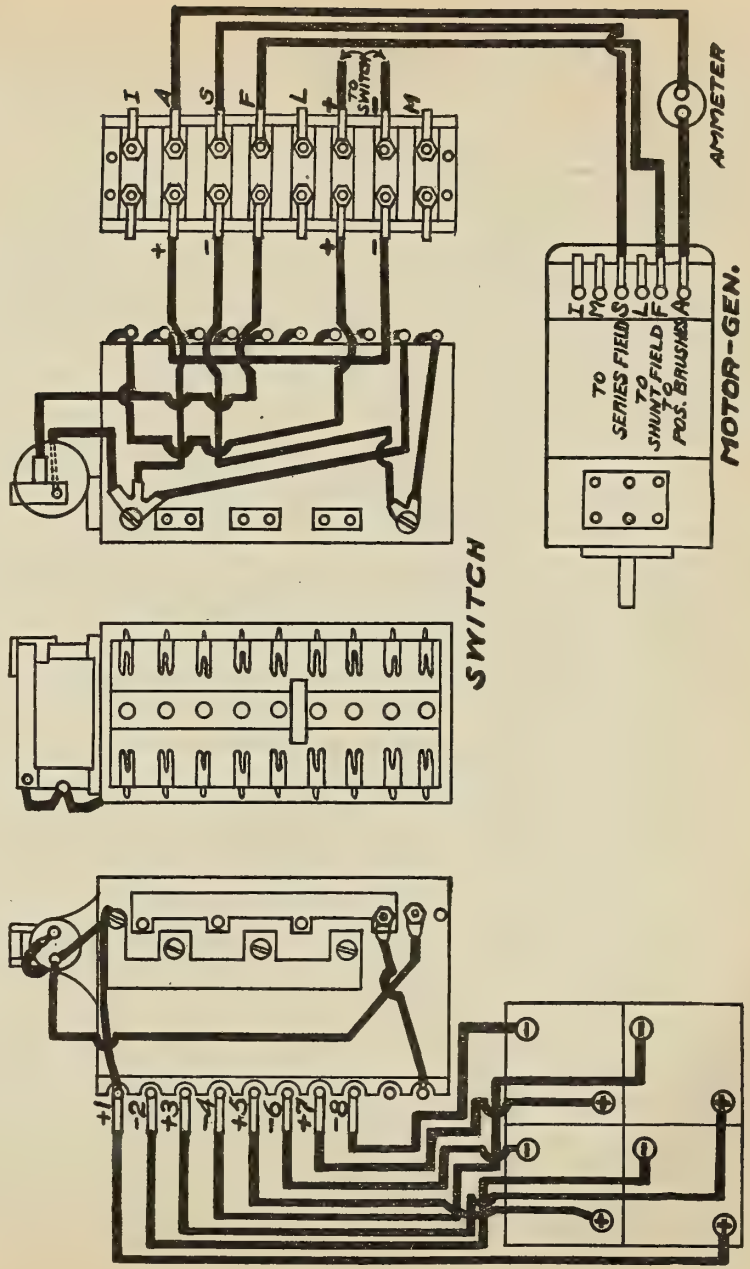
CUT-OUT: Magnetic, mounted on top of commutating starting switch unit. Closes at 6.5-7.5 volts, 1100 R. P. M. Opens with discharge of 1.0-2.0 amperes.

Adjusted by altering air gap between armature and magnet core. Gap is adjusted by moving the stop that limits the travel of the armature when the contacts are separated.

STARTER: Acts as a compound wound starting motor.

Battery is in four sections of three cells and six volts each. Through the commutating switch, these four sections are connected in parallel, with all positive terminals together and all negatives together, for charging and lighting. With the switch moved to the starting position, the four sections of the battery are connected in series with each other, giving 24-volt pressure for cranking.

DIAGRAM: See Diagram 1091 opposite.



ESTERLINE

PERMANENT MAGNET GENERATOR

TYPES: Type D, Series B and Series C.

VOLTAGE: 6.

CHARGE RATE: Series B, all lamps off, maximum output 10-12 amperes; with lamps on maximum is 12-15 amperes.

Series C, maximum output 12-15 amperes.

GENERATOR: Two pole machine with permanent magnet fields in conjunction with field windings carried on core across arch of magnets and above armature.

Two brushes on opposite sides of commutator; positive on right, negative on left.

Series B has three field windings on the core; one a shunt coil, another a reversed series coil, and the third a load winding.

Series C has two field windings: a shunt coil and a reversed series coil

Series B has four wire terminals on the dynamo, Series C has two terminals.

Test Terminals: Ammeter between terminal 2 and wire removed on either machine. Voltmeter on Series B between terminals 1 and 2; on Series C between terminals 2 and 3.

Field Terminals: Series B has shunt field between terminals 1 and 4, reversed series (Batt) field between terminals 1 and 3, load field winding between terminal 2 and positive (right hand) brush. Series C has shunt field between terminals 3 and 4 (see diagram), series field between terminal 2 and positive brush.

REGULATION: Reversed series field windings oppose shunt and permanent magnet fields to limit output. On Series B machine the output is increased by the load winding when the lamps are turned on. No adjustment provided.

CUT-OUT: Magnetic, carried on fuse panel.

Closes at 375-400 R.P.M., 6.5-7.5 volts; opens with discharge of 0.0-1.5 amperes.

Spring tension and armature gap adjusted by screws passing through contact arms and armature on top of unit.

DIAGRAMS: See Diagrams 1125 and 1126.

FORD

LIBERTY SYSTEM, STANDARD EQUIPMENT

MODEL: FA.

VOLTAGE: 6.

CHARGE RATE:

Speed	Cold Generator		Hot Generator	
	Amperes	Volts	Amperes	Volts
800 R. P. M.	3.7- 4.5	6.6	2.3- 3.2	6.6
1100 R. P. M.	8.5- 9.5	7.4	6.5- 7.7	7.1
1400 R. P. M.	11.0-12.0	7.9	9.5-10.5	7.4
1700 R. P. M.	12.0-13.0	8.3	10.5-11.5	7.6
2000 R. P. M.	10.6-11.5	8.1	9.0-10.5	7.5

GENERATOR: Four pole shunt wound machine with four field coils. Two main brushes set at 90 degrees from each other on lower side of commutator, third brush on upper side of commutator.

Test Terminals: Ammeter between terminal on side of cut-out and wire removed or between large terminal on generator and wire removed (with separate cut-out). Voltmeter between large terminal on top of generator and ground.

Field Terminals: Shunt field between third brush and negative grounded (left hand) main brush. Field current 2.5 amperes at 6.1 volts.

REGULATION: Third brush controls field current and output. Moving this brush in the direction of armature rotation (to the left, facing commutator end) increases the output; moving it against rotation lowers the output.

Third brush holder is bolted to main brush ring and with bolt loosened the brush may be moved either way for adjustment.

CUT-OUT: Magnetic, mounted on generator in all later equipments; on dash in earlier types.

Closes at 600-650 R.P.M., 6.5-7.0 volts, 0.5-1.5 amperes.

Opens with discharge of 0.5-2.5 amperes.

Spring tension adjusted by bending brass lip that holds the free end of the spring. Armature gap adjusted by bending the curved brass stop that limits the separation of the contacts and against which the armature rests with the contacts open.

STARTER: Four pole series wound motor with four brushes. Two opposite negative brushes grounded. Two field coils in series between terminal and one positive brush, other two coils in series between terminal and other positive brush.

Ft.-Lb. Torque	Amperes	Volts	R. P. M.
1	120	5.6	2550
5	325	4.5	1070
9	460	3.7	430
13	580	3.1	locked

DIAGRAM: See Diagram 1251.

GRAY & DAVIS

CONSTANT SPEED GENERATOR

TYPES: Generators, E and G-1. Motors, H-1, H-2 and K.

VOLTAGE: 6.

CHARGE RATES: Due to constant speed and voltage, the charge rate is high with a discharged battery and low with a charged battery. With a lamp load the machine is compounded and increases the rate.

Type	Speed	Charged Battery		Discharged Battery
		No Lamps	7-8 Amps. Lamp Load	No Lamp Load
E	Above 700 R. P. M.	4.0-9.0 amps.	1.0-2.0 amps.	10.0 amps.
G-1	Above 1000 R. P. M.	4.0-6.0 amps.	1.0-1.5 amps.	8.5 amps.

GENERATOR: Type E is a four pole machine, type G-1 is a two pole machine.

Three terminals on commutator end at commutator cover, marked S, − and +, from left to right.

Two main brushes on opposite sides of commutator, positive at right, negative at left.

Test Terminals: Ammeter between terminal + and wire removed, voltmeter between terminals + and −.

Motoring current, 2.0-3.0 amperes at 6.3 volts.

Field Terminals: Shunt field between terminals + and −, series (compound) field between terminals S and −.

Two wire or one wire, grounded, system. On one wire system, positive side of battery is grounded at battery or at starting motor end of starter cable.

REGULATION: Constant speed maintained at engine speeds above setting by a slipping clutch governor. Clutch consists of a shell attached to the shaft driven from the engine. Two shoes drive the armature shaft, these shoes being held against the inside of the shell by springs. The shoes are faced with $\frac{1}{8}$ in. asbestos fabric. Above the rated speed of the armature, the shoes slip, due to centrifugal action of two attached weights.

To adjust clutch, remove cover at drive end and revolve the governor inside the shell until the opening in the shoe (marked with notch) lines up with drilled hole in shell. Use a screwdriver $\frac{3}{16}$ in. wide to turn screw. Turning screw to right tightens spring and increases output, turning to left lowers output. This adjustment affects only the maximum charging rate.

The lamp current returns to the generator through the compound series field winding and as this winding assists the shunt, the output is increased in proportion to the number of lamps turned on.

CUT-OUT: Magnetic, mounted as a separate unit.

Closes on type E at 600-700 R.P.M., opens with discharge of 0.5-2.0 amperes.

Closes on type G-1 at 900-1000 R.P.M., opens with discharge of 0.5-2.0 amperes.

Armature gap adjusted by moving armature stop, spring tension changed by bending flat spring with flat nosed pliers.

Cut-out should be mounted horizontally with contacts underneath. If mounted vertically, contacts should be down.

Contacts and series winding between left hand terminal and lower right hand terminal (facing front of cut-out). Shunt winding between upper and lower terminals at right side.

STARTER: Two pole series wound motor with two brushes on opposite sides of commutator. Two halves of series field in parallel between right hand terminal and right hand brush.

Type H-1 uses a double spur gear reduction to the flywheel. Type H-2 drives through chain with overrunning clutch. Type K has a built-in planetary reduction gearing and drives through a chain.

Type H-1 takes 150 amperes, 6.0 volts, at.....1500 R. P. M.
Type H-2 takes 150 amperes, 6.0 volts, at.....2600 R. P. M.
Type K takes 100 amperes, 6.0 volts, at.....3600 R. P. M.

Type H-1 uses a two point starting switch with resistance between first contact and the cable terminal so that the motor runs light while the gears are meshed. This resistance is cut out with the full throw. Types H-2 and K use a single contact switch.

UPKEEP: If lights grow dim when car is speeded up, wires on terminals S and − are reversed.

If generator is belt driven, the belt may slip and cause low output.

Copper-carbon (Bronscol) brushes are used in the motor.

Dynamos are built to run clockwise (from drive end). If to be run counter-clockwise, reverse the brush leads to terminals + and −, connecting left hand brush (commutator end) to + terminal and right hand brush to − terminal.

DIAGRAMS: See Diagrams 1351 and 1353.

GRAY & DAVIS

CONSTANT SPEED GENERATOR

TYPE: C-1.

VOLTAGE: 6.

CHARGE RATE: Due to constant speed and voltage, the charge rate is high with a discharged battery and low with a charged battery. With a lamp load the machine is compounded and increases its output.

Above 1250 R. P. M., charged battery, no lamp load	3.0-8.0 amps.
Above 1250 R. P. M., charged battery, 7-8 ampere load	0.5-1.5 amps.
Above 1250 R. P. M., discharged battery, no lamp load	10.0 amps.

GENERATOR: Two pole machine.

Three terminals at commutator end, marked −, S and +, from left to right, clockwise rotation.

Otherwise generator is same as preceding section.

REGULATION: Constant speed above rated point, maintained by slipping clutch governor. Clutch consists of two discs, one attached to engine driving shaft, other to armature shaft, these discs being held together by a spring. Above the rated speed (1250 R.P.M.) the discs slip, due to the centrifugal action of governor weights.

To adjust clutch, remove the cover at the drive end first. In the bar connecting generator ends of governor weights is a set screw which is to be loosened one full turn. Then insert two screwdrivers, one on each side, back of the bars connecting the weights. Compressing the spring will raise the output. Movement of $\frac{1}{16}$ in. on the spring length will raise output about 2.0 amperes. This adjustment affects only the maximum charging rate.

The lamp current returns to the generator through the compound series field winding and as this winding assists the shunt, the output is increased in proportion to the lamp load.

CUT-OUT: Same as for preceding section.

STARTER: Same as for preceding section.

UPKEEP: Same as for preceding section.

DIAGRAMS: See Diagrams 1352 and 1353.

GRAY & DAVIS

CONSTANT CURRENT GENERATORS

TYPES: S and T generators. Y starting motor.

VOLTAGE: 6.

CHARGE RATES:

Type S—	Charge with No Lamp Load	Net Charge with 7.5 Amps. Lamp Load
450 R. P. M.	Cuts in	.....
500 R. P. M.	5.0 amps.	Cuts in
550 R. P. M.	8.0 amps.	4.0 amps.
650 R. P. M.	10.5 amps.	8.0 amps.
750 R. P. M.	11.5 amps.	9.0 amps.
850 R. P. M. and over	12.0 amps.	9.5 amps.
Type T—		
700 R. P. M.	Cuts in	Cuts in
800 R. P. M.	5.5 amps.	5.0 amps.
900 R. P. M.	8.0 amps.	7.5 amps.
1000 R. P. M.	9.5 amps.	8.0 amps.
1100 R. P. M. and over	10.0 amps.	8.2 amps.

GENERATOR: Two pole machine, shunt wound. Two brushes on opposite sides of commutator; negative brush connected to terminal A and positive brush grounded. Positive brush on right (facing commutator) with counter-clockwise rotation, on left with clockwise rotation.

Test Terminals: Ammeter between regulator terminal B and wire removed or between generator terminal A and regulator terminal A. Voltmeter between generator terminal A and ground.

Motoring Current: Type T, 3.0 amperes, 6.0 volts, 650 R.P.M. Type S, 3.0 amperes, 6.0 volts, 320 R.P.M.

Field Terminals: Shunt field between generator terminals F and F′.

Field Current: Type T, 1.04-1.30 amperes at 6.0 volts. Type S, 1.09-1.32 amperes at 6.0 volts.

Terminals on top of generator at commutator end, A, F, F′, from left to right.

REGULATION: Constant amperage above rated speed maintained by vibrating type regulator type D, combined with cut-out and mounted on top of generator.

Regulator has three terminals, A, F, F′, at commutator end; A connected to positive brush, to regulator contacts, to cut-out contacts, and to regulator shunt winding; F connected to shunt field upper coil, to one pair of regulator contacts and regulator resistance; F′ connected to shunt field lower coil, to other pair of regulator contacts and regulator resistance.

Regulator has two terminals at drive end; L connected to lighting lines, B connected to battery negative. Terminal L is connected between the ends of the series regulator coil so that current drawn to the lamps is subtracted from the regulating current and the dynamo output is allowed to rise in proportion to the lamp load. Terminal B is connected to one end of the series regulator winding and the other end of this winding is connected to the cut-out contacts. The terminal between B and L is used for grounding one end of the shunt winding of the regulator-cut-out.

The charge rate is increased by increasing the spring tension by turning in the screw bearing against the spring. This screw is released by loosening the lock screw first.

In adjusting, the upper pair of points should be opened with a match or the fingers while the lower set is adjusted to give the correct output, then release the upper pair, block the lower open, and adjust the upper pair to give the same rate.

The air gap between armature and magnet with contacts closed should be .025 in., between magnet and small button on armature, the gap should be .010 in.

CUT-OUT: Magnetic, combined in single unit with regulator on top of generator.

Closes at 6.0-6.5 volts, 450-500 R.P.M. on Type S, 700 R.P.M. on Type T.

Opens with discharge of 0.5-2.0 amperes on either type.

On cut-out with flexible arm carrying moving contact, the gap between the separated contacts should be .015 in., the armature air gap should be .030 in.

On the cut-out having solid arm carrying movable contact, the gap between separated contacts should be .010 in., the armature air gap should be .015 in.

Spring tension on the flexible arm type is adjusted by turning the adjusting screw at the hinged end of the spring inward to increase the tension, out to decrease it. This screw is held by a lock nut.

Spring tension on the solid arm type is adjusted by turning the screw head at the upper end of the coiled spring. This screw is held by lock nuts which must be released.

Air gaps are adjusted by bending the armature stops.

STARTER: Two pole series wound machine, two brushes on opposite sides of commutator. One brush connected directly to one terminal. Series field coils connected in series between other brush and other terminal.

Delivers 1.12 ft.-lb. torque at armature shaft, running at 2525 R.P.M., drawing 100 amperes at 5.5 volts.

DIAGRAMS: See Diagrams 1355, 1356 and 1357.

GRAY & DAVIS

MOTOR-GENERATOR

TYPES: 9, 300, 301, etc.

VOLTAGE: 6.

CHARGE RATE: Normal setting, 8.0 amperes at 1575 R.P.M.

Maximum output, 8.5-11.0 amperes.

The lamp load is not connected to the regulator winding and does not affect the charge rate.

MOTOR-GENERATOR: Four pole machine with two field coils, one above armature and other below. Each coil contains shunt and series windings.

Two brushes set at 90 degrees from each other; positive on left side of commutator, negative on top.

Single armature, one winding, one commutator.

Test Terminals: Ammeter between wire removed from terminal at drive end of machine and the terminal from which removed; or between motor-generator terminal A and regulator terminal A, these being the left hand terminals facing the commutator end. Voltmeter between above mentioned terminals and ground.

Motoring Current: 10 amperes at 6.0 volts, 700 R. P. M.

Field Terminals: Terminals on top of motor-generator are marked A, F and F′, from left to right facing commutator end. Shunt field winding between terminals F and F′. Top series winding between upper terminal on side of motor-generator and upper brush; lower series winding between lower terminal on side of motor-generator and left hand brush.

Field Current: 1.0-1.2 amperes at 6.0 volts for shunt field.

REGULATION: Constant amperage maintained above rated speed by vibrating type regulator.

Regulator action and adjustment same as for preceding section, except that the lamp current is not taken from the regulator and consequently there is no L terminal.

CUT-OUT: Magnetic, combined with regulator on top of motor-generator.

Adjustment same as for preceding section, except closing speed, which is 1100-1150 R.P.M.

DIAGRAMS: See Diagrams 1360 and 1361.

GRAY & DAVIS

CONSTANT CURRENT GENERATORS.

TYPES: Generators, 200, etc. Motors, 100 etc,

VOLTAGE: 6.

CHARGE RATES:

Type	R. P. M. at 10 Amperes	Max. Amps. with 7.5 Amps. Lamp Load	Type	R. P. M. at 10 Amperes	Max. Amps. with 7.5 Amps. Lamp Load
210, 237	750	8.5-12.0	236	600	8.5-11.0
211	1300	8.5-11.0	238, 239	1300	8.5-11.0
212-218	1300	8.5-12.0	240-244	700	8.5-11.0
219	1300	8.5-11.0	245	600	8.5-11.0
220	600	8.5-11.0	246	700	8.5-12.0
222	700	8.5-11.0	247	600	8.5-12.0
223	700	8.5-12.0	248	600	8.5-11.0
224	600	8.5-12.0	249-252	700	8.5-11.0
225	600	8.5-11.0	253	600	8.5-11.0
226	700	8.5-11.0	254	700	8.5-12.0
227	1300	8.5-12.0	255	600	8.5-12.0
228	1300	8.5-11.0	256	600	8.5-11.0
229	700	8.5-11.0	257, 258	700	8.5-11.0
230, 231	700	8.5-12.0	259	600	8.5-12.0
232	600	8.5-12.0	260	700	8.5-11.0
233	700	8.5-11.0	261, 262	600	8.5-12.0
234, 235	1300	8.5-11.0	.....	.....	.....

GENERATOR: Four pole shunt wound machine with two field coils, one above the armature and one below.

Two brushes set at 90 degrees from each other, one above center and one below center, on either right or left hand side of commutator.

Test Terminals: Ammeter between regulator terminal B and wire removed, or between generator terminal A and regulator terminal A. Voltmeter between generator terminal A and ground.

Motoring Current: At 6.0 volts and 3.0 amperes—

300-335 R. P. M. on 210, 220, 222, 223, 224, 225, 226, 229, 230, 231, 232, 233, 236, 237, 240 to 262 inclusive.

650 R. P. M. on 211, 212, 213, 214, 216, 217, 218, 219, 227, 228, 234, 235, 238, 239.

Field Terminals: Shunt field winding between generator terminals F and F'.

Field Current: At 6.0 volts, shunt field current is—

0.75-1.00 amps. for 220, 222, 223, 224, 225, 226, 229, 230, 231, 232, 233, 236, 243, 260.
1.00-1.30 amps. for 210, 211, 212, 213, 214, 216, 217, 218, 219, 227, 228, 234, 235, 237.
2.00-2.50 amps. for 238, 239. 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 261, 262.

REGULATION: Constant amperage maintained above rated speed by vibrating type regulator. Same action and adjustment as preceding section 1303.

CUT-OUT: Magnetic, combined with regulator on top of generator.

Closes at 6.5-7.0 volts; 360-400 R.P.M. on engine speed generators, 450-500 R.P.M. on generators driven 1½ times engine speed.

Opens with discharge of 0.0-2.0 amperes.

Adjustment same as for preceding section 1303.

STARTER: Motors, Types 100, etc., four pole, series wound machines with two field coils, one above armature and one below. Two brushes set at 90 degrees from each other. Upper series field between terminal on top of motor and brush, lower field coil between other brush and ground.

Types	Running Free			Running Torque			
	Amps.	Volts	R.P.M.	Ft.-Lb.	Volts	Amps.	R.P.M.
110, 122, 141, 142.....	35	5.5	1900	1.5	5.75	98	1980
119, 120, 121, 126, 127, 129, 130, 131, 132, 138, 139, 140.	35	5.5	4500	1.5	5.75	100	1660
100 to 109, 113, 115 to 118, 123 to 125, 128, 133 to 137.	35	5.5	6600	1.5	5.75	137	2400

DIAGRAMS: See Diagram s 1367 and 1368.

GRAY & DAVIS

THIRD BRUSH GENERATORS

TYPES: 400, etc.

VOLTAGE: 6.

CHARGE RATE:

Rev. per Min.	Engine Speed Generator	1½ Eng. Speed Generator
450	Cuts in	.....
550	5.2- 6.0 amps.	.....
650	8.5-10.0 amps.	Cuts in
800	12.2-13.5 amps.	4.5- 5.5 amps
1000	13.0-15.0 amps.	9.0-10.5 amps
1200	12.0-13.0 amps.	12.5-14.0 amps
1400	.....	13.0-15.0 amps
1600	.....	11.7-13.0 amps

GENERATOR: Four pole shunt wound machine with two field coils, one above armature and one below. Two main brushes on one side of commutator and at 90 degrees from each other. Third brush on opposite side of commutator.

Test Terminals: Ammeter between generator terminal and wire removed; voltmeter between this terminal and ground.

Motoring Current: 3.0-3.5 amperes at 325-375 R.P.M.

Field Terminals: Shunt field between third brush and positive main brush.

REGULATION: Third brush controls field current and output. Third brush mounted on movable ring and making contact with commutator on opposite side from main brushes. Moving the brush with the direction of armature rotation increases the charge rate, moving it against rotation lowers the rate.

The third brush is moved by turning a small stud appearing through the housing in the upper corner. Turning the stud one direction rotates the brush holder and moves the brush in the opposite direction.

CUT-OUT: Magnetic, mounted in commutator end of generator.

Closes at 6.25-7.25 volts, 0.0-3.0 amperes; 400-500 R.P.M. in engine speed generators, 650 R.P.M. in generators driven 1½ times engine speed.

Opens with discharge of 0.0-2.0 amperes.

The gap between the end of the magnet core and the armature should not be less than .020 in. with contacts closed. The gap between the opened contacts should be .015 in. The contact gap is adjusted by bending the stationary contact arm; the armature gap is adjusted by bending the armature stop.

Spring tension is adjusted by bending the support that holds the free end of the spring.

STARTER: Uses starting motors, Type 100, etc., as described in preceding section.

DIAGRAMS: See Diagrams 1366 and 1368.

GRAY & DAVIS

ROUND GENERATORS, THIRD BRUSH REGULATION

TYPES: 600, etc.; 800, etc.

VOLTAGE: 6.

CHARGE RATES:

Rev. per Min.	600 Series	800 Series
400	.....	Cuts in
500	Cuts in	4.5- 6.0 amps.
700	5.5- 7.0 amps.	9.6-11.4 amps.
900	9.0-10.2 amps.	13.0-15.0 amps.
1300	13.4-14.6 amps.	16.5-18.0 amps.
1700	14.7-16.0 amps.	14.5-16.0 amps.
2500	12.0-13.0 amps.	10.5-11.2 amps.

Higher rates will be secured with cold generator or charged battery, lower rates with hot generator or discharged battery.

GENERATOR: Four pole shunt wound machine with four field coils. Two main brushes set at 90 degrees from each other; third brush on opposite side of commutator from main brushes.

Series 600 generators are 4 in. diameter and are driven at approximately 1½ times engine speed; series 800 generators are 5 in. diameter and are driven at approximately engine speed.

One wire system with positive grounded.

Test Terminals: Ammeter between lead from generator to cut-out and terminal from which lead is removed on cut-out. Voltmeter between this terminal on cut-out and ground.

Motoring Current: Series 600 generators take 4.0-4.5 amperes running at 350-425 R.P.M. Series 800 generators take 3.5-4.0 amperes running at 300-350 R.P.M.

Field Terminals: Shunt field between field fuse and lead from generator to cut-out; or between field fuse and negative (ungrounded) brush.

Field Current: 2.5-3.0 amperes at 6.3 volts.

Field Fuse: Fuse of 5 ampere capacity mounted on commutator end of generator and connected between third brush and shunt field winding.

REGULATION: Third brush controls field current and output. Third brush is opposite main brushes on commutator, and is carried by a ring member having teeth in its edge which are engaged by the teeth of a small pinion whose stud appears through the commutator end head of the generator, either above or below the center.

Moving the third brush in the direction of armature rotation increases the charge rate, moving it against rotation lowers the rate. The pinion stud has a screwdriver slot and turning the pinion one direction rotates the third brush in the opposite direction; therefore, to increase the charge rate, the pinion is turned against armature rotation.

CUT-OUT: Magnetic, mounted on top of generator or on commutator end of generator.

Closes at 6.5-7.0 volts, 1.0-2.5 amperes; 450-550 R.P.M. on series 600 generators, 350-450 R.P.M. on series 800.

Opens with discharge of 0.0-2.0 amperes.

Armature gap adjusted to .010-.015 in. by bending stop on outside of movable cut-out contact. Spring tension adjusted by bending lip which is attached to armature and which catches the free end of the spring.

STARTER: Starting motors, series 500 (4 in. diameter) and series 700 (5 in. diameter), are four pole series wound machines with four field coils and four brushes.

Two field coils are connected to the motor terminal with the other end of each coil attached to one brush. The other two field coils are grounded at one end with their remaining ends attached one to each of the remaining two brushes.

DIAGRAMS: See Diagrams 1372, 1373 and 1374.

JESCO

MOTOR-GENERATOR, 8-16 VOLT SYSTEM

SIZE: 3-13.

VOLTAGE: 8 for charging and lighting, 16 for starting.

CHARGE RATE: With the small current control lever on the bottom of the controller moved toward the right to "HIGH," at speeds of 2000-2500 R.P.M. of armature, the rate should be from 12.0-13.0 amperes at 9.5-10.5 volts.

MOTOR-GENERATOR: Four pole machine with four field coils. Each coil contains starting series, reversed series and generator shunt windings.

Two brushes set at 90 degrees from each other on upper side of commutator, positive at right, negative at left.

Single armature with one winding and one commutator for both charging and starting.

Test Terminals: Ammeter in line with large (No. 4 gauge) yellow cable running from positive brush to one positive terminal of the battery. Voltmeter between two main brushes or between upper right hand and lower left hand starting contacts in the controller.

Field Terminals: Shunt field winding between positive brush and white wire coming from motor-generator to controller. Reversed series field between negative brush and white wire from motor-generator to controller. Starting series field between negative brush and brown (No. 12) wire from motor-generator to controller.

REGULATION: Reversed series field winding in parallel with regulating resistance and regulator contacts in controller. With contacts closed the reversed series field is short circuited. When current rises to value for which regulator is set, the contacts open and the current is forced back through the reversed series field by the regulating resistance.

The regulator is the unit in the bottom of the controller housing. Its permanent adjustment (setting) is changed by turning the small screw that carries the upper regulator contact toward the front of the unit.

Running adjustments are made with the small lever on the bottom of the controller. Moving this lever toward the right to the word "HIGH" gives the maximum output; moving it to the left, toward "LOW," lowers the output.

CUT-OUT: Magnetic, carried in the center of the controller unit.

Closes at 1100-1200 R.P.M., 9.5-10.0 volts; opens with discharge of 0.5-2.5 amperes.

The cut-out is opened by gravity. The gap between the upper and lower members is altered by the nut on the bottom of the lower member. The voltage of closing is lowered by lessening the gap and increased by increasing the gap.

STARTER: Machine acts as a compound wound starting motor with the two halves of the battery connected in series by pressing down on the controller handle to close the starter contacts.

DIAGRAMS: See Diagrams 1375 and 1378.

JESCO

MOTOR GENERATOR, 6-VOLT, TWO WIRE SYSTEM

MODELS: 3418, 5358 and 5700.

VOLTAGE: 6.

CHARGE RATE: Depends on adjustment of regulator. With cold generator and charged battery, the normal maximum rate at speeds of 1500 R.P.M. and over is from 12.0-15.0 amperes. The regulator adjustment may be set anywhere between 8.0 and 15.0 amperes.

MOTOR-GENERATOR: Four pole machine with four field coils, each coil containing generator shunt winding, reversed series winding, and starting series winding.

Armature has two windings and two commutators. The commutator toward the armature is for the starter and has four brushes equally spaced around it. The commutator farthest from the armature is for the generator action and has two brushes set at 90 degrees from each other on the lower side of the commutator.

Test Terminals: Ammeter between small terminal between two large terminals on controller and wire removed. Voltmeter between this small terminal and the large left hand terminal (looking at the terminal end of the controller).

Field Terminals: Shunt field winding between the vibrating (outside) member of the regulator and the small spring contacts resting against the inside end of the left hand large terminal in the controller. Reversed series field between these spring contacts and the attachment of the red wire to the regulator body. Starting compound field between the left hand large terminal and the positve (upper right and lower left) motor brushes.

REGULATION: Constant amperage maintained above 1500 R.P.M. by vibrating regulator whose contacts and armature are at the left hand of the controller magnet when facing the terminal end of this unit.

The regulator contacts and a resistance winding on the controller magnet are in parallel with the reversed series field windings. With current flow below the rated output, the contacts are closed, short circuiting the reversed series field and allowing the machine to act as a shunt generator. With current above the rated setting the contacts are opened and the resistance winding forces the current back through the reversed series field to maintain the desired output.

The regulator adjusting screw is in the center of the regulator armature. Turning this screw in (to the right) lowers the charge rate; turning it out raises the charge rate.

CUT-OUT: Magnetic, carried in the controller with the regulator and the starting switch. The cut-out contacts and armature are on the right hand side of the unit when facing the terminal end.

Closes at 7.0-7.5 volts, 750-800 R.P.M., opens with discharge of 0.0-2.0 amperes.

The spring tension is adjusted by bending the large bracket attached to the top of the cut-out body and which carries the end of the spring toward the contacts. The armature and contact gap is adjusted by bending the small lip against which the end of the armature rests when the contacts are open.

STARTER: The machine acts as a compound wound starting motor when the switch contacts in the controller are closed by the operating lever.

The switch consists of a laminated contactor making contact with the right hand (negative) terminal. As the switch is closed the negative side of the battery is connected through the contacts and large red wire to the motor field windings, brushes, armature, and through the large yellow wire to the positive terminal and positive side of the battery. The spring contacts that normally rest against the inside of the positive terminal leave this terminal when the starting switch is closed and break the circuit between the shunt and reversed series fields and the positive side of the battery.

DIAGRAM: See Diagram 1377.

JESCO

TANDEM CONNECTED MOTOR AND GENERATOR

MODEL: 7-NU.

VOLTAGE: 6.

CHARGE RATE: Same as for preceding Section 1352.

GENERATOR: The generator is built in the front (drive) end of the single aluminum casting that houses both generator and motor.

Four pole machine with four field coils, each coil containing shunt and reversed series windings.

Two brushes set at 90 degrees from each other on upper side of commutator, right hand brush negative, left hand (grounded) brush, positive.

Test Terminals: Ammeter in line with large black wire from generator to regulator or between terminal on controller housing and wire removed. Voltmeter between right hand (negative) brush or terminal on controller and ground:

Field Terminals: Shunt field between red wire connected to regulator contact and connection of yellow wire to the left hand (positive) brush. Reversed series field between red wire connected to regulator contact and small black wire attached to the right hand (negative) brush.

REGULATION: Same as preceding Section 1352.

CUT-OUT: Same as preceding Section 1352.

STARTER: The starting motor is built in the rear end of the aluminum housing that carries generator and motor. The commutator is in the center of the machine and access to the brushes is had by removing the top and side sheet metal covers.

The engine is cranked by a pinion meshing with flywheel teeth. There is an overrunning clutch between motor and flywheel. The first movement of the starting pedal causes a preliminary contact to be made through the starting fields to ground, spinning the motor in a reverse direction and placing the pinion in mesh with the flywheel gear. Further movement of the pedal opens the preliminary starting circuit and drops the upper positive brush onto the motor commutator, thus completing the cranking circuit through the series field and armature.

Motor is a four pole machine with four field coils, each coil containing series winding and starting winding. Two main brushes, negative on left side of commutator and attached to series fields, positive above commutator and lifted for use as a starting switch. Lower brush is positive and is used for the starting field windings while gear meshing takes place.

DIAGRAM: See Diagram 1379.

LEECE-NEVILLE

SQUARE FRAME 12-VOLT UNITS, 1913 AND 1914

MODELS: 1223, etc.

VOLTAGE: 12 for charging and starting, 6 for lighting.

CHARGE RATE: Cold generator and fully charged battery. Hot generator will give 1.0-2.0 amperes less.

500 R. P. M.	3.5- 4.5 amperes
750 R. P. M.	10.0-11.0 amperes
950 R. P. M.	11.0-12.0 amperes, maximum
1250 R. P. M.	10.0-11.0 amperes

GENERATOR: 1913 Model is a two pole machine with two field coils, one above and one below the armature. Two main brushes on opposite sides of commutator.

1914 Model is a four pole machine with two field coils, one above and one below the armature, and two consequent poles. Two main brushes set at 90 degrees from each other and both on upper side of commutator.

Test Terminals: Ammeter between either cable from generator and line disconnected from this cable. Voltmeter between the two generator cables.

Field Terminals: Shunt field winding between third brush and main brush of opposite polarity.

REGULATION: Shunt field reaction limits maximum charge rate at high speeds. No adjustment is provided.

CUT-OUT: Magnetic, mounted as separate unit.

The cut-out is a two pole instrument, breaking both positive and negative sides of the charging circuit. It consists of a U-shaped member with a central core carrying the shunt and series windings. On each side is a pair of compound contacts operated by the armature. The main contacts are in the form of two small plungers for each contact and are copper to bronze. The auxiliary leaf type contacts are cophite to iron; these contacts closing first and opening last so that they take the spark of breaking the circuit.

Closes at 13.0-14.0 volts, 430-450 R.P.M.; opens at 350 R.P.M. with discharge of 1.0-2.0 amperes.

Spring tension adjusted to increase by spreading the coils of the small springs; to decrease tension by closing coils. Adjust both sides to operate evenly when pressed closed by holding small bar across moving members and closing them by pressure on middle of bar.

STARTER: 1913 Model is a two pole series wound machine with two field coils and two brushes on opposite sides of commutator.

1914 Model is a four pole machine; two field coils and two consequent poles. Two brushes at 90 degrees from each other on upper side of commutator.

Should take 40-50 amperes at 11.0-12.0 volts while cranking free engine.

DIAGRAM: See Diagram 1451.

LEECE-NEVILLE

ROUND GENERATOR, TWO-POLE CUT-OUT

MODELS: CR-400 Generator,

VOLTAGE: 6.

CHARGE RATE:

Speed	Normal Rate	Low Rate	High Rate
600 R. P. M.	8.0 amps.	7.0 amps.	10.0 amps.
900 R. P. M.	13.0 amps.	11.5 amps.	15.5 amps.
1200 R. P. M.	15.0 amps.	13.0 amps.	17.0 amps.
1500 R. P. M.	13.0 amps.	11.0 amps.	15.0 amps.

GENERATOR: Four pole shunt wound machine with four field coils.

Two main brushes set at 90 degrees from each other on upper side of commutator. Third brush at right of right hand main brush.

Test Terminals: Ammeter between either terminal on commutator end head of generator and wire removed. Voltmeter between two terminals on commutator end head of generator.

Field Terminals: Shunt field coils in series between third brush and main brush lead farthest from third brush.

REGULATION: Third brush controls field current and output. Moving the third brush with direction of armature rotation increases the charge rate; moving it against rotation lowers the rate. The third brush is accessible after removing the band around the commutator end head of the machine.

To adjust the rate; loosen the set screw on the right hand side of the commutator end of the generator. This loosens the third brush bracket and the bracket and brush can then be moved in either direction, after which the set screw is tightened.

If the adjustment brings the third brush in contact with the main brush, loosen the two set screws on the commutator end housing above the shaft center and move the main brush holder just far enough away from the third brush so that the two brushes are clear.

CUT-OUT: Magnetic, mounted as separate unit. Two pole type, same as described in Section 1401.

Closes at 350-400 R. P. M., 6.5-7.0 volts; opens with discharge of 1.0-2.0 amperes.

DIAGRAMS: See Diagrams 1451 and 1452.

LEECE-NEVILLE

ROUND GENERATORS, SINGLE POLE CUT-OUT

MODELS: C-400, G-153, G-192, G-234, G-326, G-342, G-343, G-363, G-377, G-382, G-385, G-395.

CHARGE RATE:

Speed	6-Volt Units	12-Volt Units Passenger Car	12-Volt Units Truck
700 R. P. M.	6.0- 7.0 amps.	2.0- 3.0 amps.	1.0-2.0 amps.
1000 R. P. M.	11.0-13.0 amps.	9.0-10.0 amps.	5.0-6.0 amps.
1300 R. P. M.	16.0-18.0 amps.	10.0-12.0 amps.	7.0-8.0 amps.
1400 R. P. M.	16.0-18.0 amps.	11.0-12.0 amps.	7.0-8.0 amps.
1800 R. P. M.	14.0-16.0 amps.	9.0-10.0 amps.	6.5-7.0 amps.

GENERATOR: Four pole shunt wound machine with four field coils. Two main brushes set at 90 degrees from each other on upper side of commutator. Third brush may be between main brushes, or outside either the right hand or left hand main brush, or on the lower side of the commutator.

Test Terminals: Ammeter on three terminal machine between either main terminal and wire removed; on two terminal machines between either terminal and wire removed; on single terminal machine between terminal and wire removed. Voltmeter between two main terminals, or single terminal and ground.

Field Terminals: Shunt field between third brush and field fuse clips with field fuse carried on generator housing or inside generator. On three terminal machine the shunt field is between the third brush and the line running to the field (left hand) terminal on the cut-out.

Field Fuse: Fuse of 5-ampere capacity for 6 volt machines, 10-ampere for 12 volt, mounted in cut-out for three terminal machine; or on generator housing or on generator brush rigging for one and two terminal machines.

Motoring Current: 6 volt machine, 6.0 amperes, 6.0 volts, 375 R. P. M.

REGULATION: Third brush controls field current and output. Moving this brush with the direction of armature rotation increases the output rate; moving it against rotation lowers the rate.

The third brush is held in a bracket attached to a toothed sector. Engaging this sector is a pinion attached to a thumb screw that appears on the commutator end head of the machine. Turning this screw in one direction rotates the third brush in the opposite direction, so that the screw is rotated in the direction opposite armature rotation to increase the charge rate. The adjusting screw is turned after loosening the locking screw at one side of the thumb screw.

Other types fasten third brush holder with two screws at the top. With the screws loosened the holder can be moved either way.

If the adjustment brings the third brush into contact with the main brush; loosen the screws holding the main brush plate and move the main brushes far enough away from the third brush so that they clear.

CUT-OUT: Magnetic, mounted on the generator or carried as a separate unit. In one type of cut-out, the field fuse is mounted on one end of the unit and the connector for the outside line on one side. In the other type of cut-out there is no field fuse and there are three terminals on one end, these being marked B, BG, and G.

Closes on 6 volt units at 450 R. P. M., 6.0-7.5 volts; on 12 volt units at 650 R. P. M., 12.0-15.0 volts.

Opens on 6 volt units with discharge of 0.0-4.0 amperes; on 12 volt units with discharge of 0.0-2.5 amperes.

Spring tension adjusted by turning small screw to which one end of spring is attached. This screw is fastened with a lock nut.

Armature gap adjusted by bending armature stop.

CIRCUIT BREAKER: An overload circuit breaker takes the place of fuses. With excessive discharge from the battery, the breaker arm flies up to the "OFF" position. It is re-set by moving the arm down again to the "ON" position.

The adjusting screw is in the end of the housing. A small screwdriver can be inserted in the hole in the bottom of the case and turned to the left (unscrew) to increase the capacity of the breaker before it opens.

DIAGRAMS: See Diagrams 1453, 1454, 1455, 1457, 1458, 1461, 1462, 1463, 1464.

LEECE-NEVILLE

STARTING MOTORS

MODELS: 380-M, 388-M, 391-M, 393-M.

MOTOR: Four pole machines with four field coils arranged in series or in parallel-series as shown in wiring diagrams.

Four brushes equally spaced around commutator, or two brushes set at 90 degrees from each other on one side of commutator.

Model	Running Free		Locked		
	Amperes	Volts	Ft.-Lb.	Amperes	Volts
380-M	.....	6.0	23 min.	.....	.....
388-M	69	6.0	20	735	3
391-M	30	12.0	33	450	7
393-M	30	12.0	33	450	7

DIAGRAMS: See Diagrams 1455, 1459, 1460, 1465, 1466, 1467, 1468

NORTH EAST

MOTOR-GENERATORS, GEAR BOX DRIVE

MODEL: A.

VOLTAGE: Charging and starting, 16 volts; lighting, 8 volts.

CHARGE RATES:

Start charge, 3.0 amperes, at.....1075 R. P. M.
5.5-6.5 amperes, maximum, at.....1500-1600 R. P. M. and above

MOTOR-GENERATOR: Four pole machine with shunt and series winding on each pole.

Two brushes set at 90 degrees from each other, positive on right, negative on left, facing commutator. Single armature and commutator.

Four binding posts numbered 1, 2, 3, 4 from right to left on all except types 1070 and 1080 which have five terminal leads numbered 1, 5, 2, 4, 3 from right to left.

Test Terminals: Ammeter between terminal 4 and positive of battery. Voltmeter between terminals 2 and 3.

Field Terminals: Shunt field between regulator contacts and terminal 2. Series field between terminals 1 and 4.

Field Fuse: 10-ampere capacity, connected between terminal 3 and line to regulator. Mounted in motor-generator housing.

REGULATION: Vibrating relay inserting resistance in shunt field circuit above amperage at which set to operate. Relay magnet carries charging current and therefore regulates amperage.

Early types used a polarized (permanent magnet) type of regulator and cut-out mounted in the drive end housing of the motor-generator. The charge rate is regulated by increasing the regulator armature gap to lower the output and by lessening this gap to increase the output. The output can be increased by increasing the spring tension and lowered by lessening the spring tension. Gap adjusted by bending the stationary contact stop; spring adjusted by bending the support.

Later types use an electromagnetic regulator and cut-out, also mounted in the drive end housing of the motor-generator. Regulator consists of a magnet whose winding carries the charging current and operating a pair of contacts having a resistance in parallel with them. With the contacts opened, the resistance is in the field circuit and maintains a constant amperage above the speed for which set. The rate is increased by increasing the spring tension or lessening the armature gap; the rate is decreased by lessening the spring tension or by increasing the armature gap.

CUT-OUT: Closes at 1075 R.P.M., 18.5 volts, 2.0-3.0 amperes. Opens with discharge of 0.0-1.0 amperes.

In the polarized (permanent magnet) type used on early models the closing point is made earlier by decreasing the spring tension and made later by increasing the spring tension.

In the electromagnet type used on later models the closing is made earlier by decreasing the armature gap, later by increasing this gap. Opening is made with less discharge by decreasing the spring tension, made with greater discharge by increasing the spring tension. The tension is altered by bending the spring support at the pivoted end of the armature.

STARTER: Machine operates as a compound wound starting motor. With armature locked, delivers 12-15 ft.-lb. torque at 45-50 amperes, 8.5 volts.

Starting switch completes circuit from series field winding through terminal 4 and armature circuit through terminal 2.

DIAGRAMS: See Diagrams 1751 and 1753.

NORTH EAST

MOTOR-GENERATOR, FIVE BINDING POSTS, GENERALLY GEAR BOX DRIVE

MODEL: B.

VOLTAGE: Charging and starting, 12, 16 or 24 volts. Lighting, 6, 8 or 12 volts.

CHARGE RATES:

12 Volt—
Start charge, 15.0 volts, at.....1050 R. P. M.
6.5 amperes, maximum, at.....1500-1600 R. P. M. and above
16 Volt—
Start charge, 18.5 volts, at.....1075 R. P. M.
5.0-6.0 amperes, maximum, at.....1500-1600 R. P. M. and above
24 Volt—
Start charge, 29.0 volts, at.....1100 R. P. M.
4.0-5.0 amperes, maximum, at.....1500-1600 R. P. M. and above

MOTOR-GENERATOR: Four pole machine with shunt and series windings on each pole.

Two brushes set at 90 degrees from each other on upper side of commutator.

Five binding posts numbered 1, 5, 2, 4, 3 from right to left. Posts 1 and 3 connect to battery, others to starting switch.

Test Terminals: Ammeter between post 1 and wire removed (engine to be cranked by hand as this connection carries starting current). Voltmeter between terminals 2 and 3.

Field Terminals: Shunt field between post 3 and terminal *d* at regulator end (right hand) of regulator-cutout assembly. Series field between terminals 1 and 4.

Field Fuse: 10-ampere capacity, mounted in commutator end housing and connected in shunt field between upper and lower field coils on right hand side.

Polarity is reversible, depending on battery connection.

REGULATION: Amperage limited above regulated speed by vibrating relay regulator inserting resistance in shunt field circuit. The machine also operates as a reversed series generator while charging.

Regulator and cut-out carried on one base in the commutator end housing of the machine. Regulator is at the right hand end of the unit. Four terminals on base, lettered *a*, *b*, *c*, *d* from left to right. Two regulating resistance units, one at each end of base. Regulator uses single electromagnet with charging current flowing through winding, and has two pairs of contacts, one pair at each side of magnet.

To adjust this regulator, proceed as follows: Make the contact faces parallel and bring their edges in alignment by bending the contact brackets if necessary. Make air gap between fully separated contacts .025 in. Hold both pairs closed and run machine at 1500-1600 R.P.M., when output should be at least 10 amperes if balance of generator is in good order. Now block one pair of contacts and adjust other pair by altering spring tension to get proper charge rate. The rate is increased by closing some coils of the spring to increase its tension, the rate is lowered by opening the spring coils to decrease the tension. Then block the adjusted contacts and proceed in the same way with the other pair. With both pairs in action, the rate will be the same as with either one, but both should be made even as described.

CUT-OUT: Magnetic, in commutator end housing on same base with regulator. Cut-out is at left hand side of unit.

Closes in 12-volt type 15.0 volts.....1050 R. P. M.
Closes in 16-volt type 18.5 volts.....1075 R. P. M.
Closes in 24-volt type 29.0 volts.....1100 R. P. M.

Opens with discharge of 0.0-1.0 ampere with either type.

To adjust the cut-out proceed as follows: Bend the stationary contact support to bring the carbon block contacts into vertical alignment. Bend the stationary contact holder and also the armature holder to bring carbon faces parallel, then incline them slightly so that their front edges will meet a little before the balance of the surface. When held tight together they will then be parallel. Adjust the air gap by bending the armature stop, this gap between separated contacts to be .030 in.; between small copper button on under side of armature and upper end of magnet core to be approximately .020 in. with contacts open.

Spring tension is reduced by spreading one or two turns or by bending down the portion of the armature spring plate that extends back beyond the iron body of the armature. The tension is increased by closing one or two coils or by bending the spring plate up.

STARTER: Machine operates as compound wound motor with following ratings, armature shaft locked:

Voltage of Unit	Ft.-Lbs. Torque	Terminal Voltage	Amperes
12	25-28	6.5	160
16	25-28	8.5	150
24	25-28	12.0	130

DIAGRAM: See Diagram 1752.

NORTH EAST

MOTOR-GENERATOR, FOUR TERMINAL LEADS OR BINDING POSTS, CHAIN OR DIRECT DRIVE

MODEL: D.

VOLTAGE: Charging and Starting, 12 or 24 volts. Lighting, 6 or 12 volts.

CHARGE RATES:

Types	Voltage	Maximum Output		Cut-in R. P. M.
		Amperes	R. P. M.	
1210, 1220	24	4.0	1500-3000	1100
1250, 1252, 1253, 1255, 3520	12	7.0	1500-3000	1050
1264	12	6.5	1500-3000	1050
3500, 3547, 3552	24	6.0	1500-3000	1150

MOTOR-GENERATOR: Four pole machine with shunt and series windings on each pole.

Two brushes of each polarity set side by side and with the pairs set at 90 degrees from each other, both on upper side of commutator.

On types using flexible leads instead of binding posts, the leads are numbered 1, 3, 2, 4 from right to left. On types using binding posts the posts are numbered 1, 2, 4, 3 from right to left. The internal connections and the external are the same, with reference to numbers, in either type.

Test Terminals: Ammeter between terminal 1 and wire removed (engine to be cranked by hand as this connection carries the starting current). Voltmeter between terminals 2 and 3.

Field Terminals: Shunt field between terminal 3 and terminal *d* at the regulator end (right hand) of regulator-cutout assembly. Series field between terminals 1 and 4.

Field Fuse: 10-ampere capacity, mounted in commutator end housing and connected in shunt field circuit between upper and lower field coils on right hand side.

Polarity is reversible, depending on battery connection.

REGULATION: Same as for preceding section 1702.

CUT-OUT: Magnetic, in commutator end housing on same base with regulator. Cut-out is at left hand end of base.

Closes:

Types 1250, 1252, 1253, 1255, 1264, 3520 at 1050 R.P.M., 15.0 volts.
Types 1210, 1220 at 1100 R.P.M., 30.0 volts.
Types 3500, 3547, 3552 at 1150 R.P.M., 30.0 volts.

Opens with discharge of 0.0-1.0 ampere for all types.

Adjustment same as for preceding Section 1702.

STARTER:

Types	Maximum Torque, Locked		
	Ft.-Lbs.	Amperes	Volts
1210, 1220	33	135	12.0
1250, 1252, 1253, 1255, 1264, 3520	29	170	6.5
3500, 3547, 3552	48	180	12.0

On the starting switch, the working faces of the contact blocks must be $\frac{5}{16}$ in. above the cover plate on which the blocks are mounted. The faces of the blocks to be .010-.015 in. above upper surface of support. The working faces should be lubricated with vaseline.

DIAGRAMS: See Diagrams 1754 and 1756.

NORTH EAST

MOTOR-GENERATOR, THIRD BRUSH REGULATION

MODEL: G.

VOLTAGE: 12 for charging, starting and lighting.

CHARGE RATE:

Cuts in, 2.5 amperes	1000 R. P. M.	7.0 amperes	1800 R. P. M.
4.7 amperes	1200 R. P. M.	6.9 amperes	2000 R. P. M.
6.0 amperes	1400 R. P. M.	5.5 amperes	3000 R. P. M.
6.7 amperes	1600 R. P. M.	4.6 amperes	4000 R. P. M.

The actual charge rate depends somewhat on the condition (voltage) of the battery. At a constant speed of 1800 R. P. M., the following rates should be obtained with varying terminal voltages:

12.0 volts	5.5 amperes	15.0 volts	7.0 amperes (normal)
13.0 volts	6.0 amperes	16.0 volts	7.5 amperes
14.0 volts	6.5 amperes		

The speed limits should be from 1775 to 1825 in this test.

MOTOR-GENERATOR: Type 3554 only—

Four pole machine with series coils on two poles and shunt coils on other two poles. Clockwise rotation from drive end.

Two main brushes set at 90 degrees from each other, positive brush at left side of commutator, negative brush on top.

Third brush at left side and below center line.

Test Terminals: Ammeter between small ungrounded (3) terminal on cut-out and wire removed. Voltmeter between ungrounded, positive, terminal on motor-generator and ground.

Field Terminals: Series field; one coil between positive terminal and positive brush, other coil between negative (grounded) terminal and negative brush. Shunt field between third brush and negative (grounded) terminal.

No field fuse used on this type.

All other types of Model G machines—

Four pole machine with shunt and series coil on each pole.

Two main brushes set at 90 degrees from each other. On clockwise rotation machines (from drive end) the positive brush is at the left and the negative on top of the commutator. On anti-clockwise rotation machines (from drive end) positive brush is on top and negative brush at left hand side. In either rotation the third brush is at the right and below the center line.

Test Terminals: Ammeter between small ungrounded (3) terminal on cut-out and wire removed. Voltmeter between ungrounded, positive terminal on motor-generator and ground.

Field Terminals: Series field, two coils between negative terminal and negative brush; two coils between positive terminal and positive brush. Shunt field between third brush and field fuse.

Field fuse, 10-ampere capacity, carried on outside of housing and connected between end of shunt field winding and ground.

REGULATION: Third brush controls field current and output. The machine operates as a reversed series generator, but the third brush forms the chief means of control.

The maximum range of the third brush setting is from 4 to 12 amperes; the setting should never be less than 4 amperes nor more than 10 amperes.

The maximum rate of 7.0 amperes (normal) is reached at 1750 R. P. M. and holds until 2000 R. P. M., after which it drops, falling to 4 amperes at 5500 R. P. M.

The third brush is moved with the directions of armature rotation to increase the charge rate and against rotation to decrease the rate, its movement either up or down depending on the direction of armature rotation.

The third brush is mounted on a ring which is freed by backing the clamp screw off one turn. The brush ring is moved by a small pinion engaging teeth in the edge of the ring, the screw operating the pinion coming through the commutator end housing of the machine.

CUT-OUT: Magnetic, mounted in starting switch housing. There are four terminals on the unit, two large ones (1 and 2) for the starting circuit, and two smaller ones (3 and 4), one of which is grounded for the cut-out shunt winding, while the other is connected to the indicator.

Closes at 14.5 volts, 1000 R. P. M.; opens with discharge of 0.0-1.0 amperes.

Adjust as follows: Dress faces of carbon contacts so that outer edges are slightly closer together than the inner edges, making them parallel when pressed tightly together. Then bend stationary contact bracket and armature contact holder to secure perfect vertical alignment.

Gap between open contacts to be .030 in.; between copper button on under side of armature and upper end of core to be .020 in. with contacts open. The gap is adjusted by bending the armature stop.

Spring tension is adjusted by opening or closing the spring coils or by bending the portion of the armature spring plate that extends back beyond the iron body of the armature.

NORTH EAST

MOTOR-GENERATOR, THIRD BRUSH REGULATION *Continued.*

STARTER: Operates as a compound wound starting motor.

	Maximum Torque, Ft.-Lbs.	Amperes	Locked Volts
On type 3554	29	180	8.75
On all other types	31	180	8.75

The starting switch consists of a pair of copper contact blocks and a laminated contactor which is attached to the push rod. The contacts should be dressed so that the outer edges of the contactor are slightly closer to the fixed contacts than the inner edges. Space between contacts with switch open to be $\frac{3}{16}$ in. on each side. Washers can be used to space the fixed contacts.

DIAGRAMS: See Diagrams 1755 and 1757.

NORTH EAST

SEPARATE UNITS, THIRD BRUSH GENERATORS

MODEL: Generators—L, M, and P.
Motors—H, K, N, and R.

VOLTAGE: 6 or 12.

CHARGE RATES:

	6-Volt Types	12-Volt Types
Cut-in, R. P. M.	550	675
Cut-in, amperes	4.0	3.0
700 R. P. M.	10.0 amperes	4.2 amperes
800 R. P. M.	13.0 amperes	7.0 amperes
900 R. P. M.	15.0 amperes	9.0 amperes
1000 R. P. M.	16.0 amperes	10.5 amperes
1200 R. P. M.	16.5 amperes	11.5 amperes
1500 R. P. M.	15.8 amperes	11.0 amperes
2000 R. P. M.	12.0 amperes	8.0 amperes

The charge rates will be somewhat lower with a discharged battery or with a hot generator.

GENERATOR: Models M and P are Model L generators with ignition units on the generators.

Two pole shunt wound machine with two field coils on opposite sides of the commutator.

Two main brushes set on opposite sides of commutator. Third brush near top of commutator, toward left hand main brush on clockwise rotation machines (from drive end) and toward right hand main brush on counter-clockwise rotation machines (from drive end).

Test Terminals: Ammeter between ungrounded (right hand) binding post from which line runs to cut-out, and the wire removed. Voltmeter between the two binding posts or between ungrounded post and ground.

Field Terminals: On clockwise rotation machines (from drive end) shunt field between third brush and the right hand ungrounded binding post; on counter-clockwise rotation (from drive end) between third brush and left hand, grounded, terminal post.

Field fuse mounted on top of commutator end of housing, connected between right hand and left hand field coils.

Generator of reversible polarity, depending on battery connection.

REGULATION: Third brush controls field current and output. The maximum limits of the brush adjustment allow a change of almost 50 per cent in the charge rate.

The third brush is moved with the direction of armature rotation to increase the rate and against armature rotation to lower the rate. Whether the brush is moved to the right or left depends on the direction of rotation.

The third brush is carried on a ring in the edge of which are teeth engaged by a small pinion. The pinion is turned by a screw coming through the commutator end housing under the center of the commutator. The brush can be seen after removing the cover band around the end of the housing.

CUT-OUT: Magnetic mounted as a separate unit.
6-volt types close at 550 R. P. M., 7.0-7.5 volts.
12-volt types close at 675 R. P. M., 14.5 volts.
Either type opens with discharge of 0.0-1.5 amperes.
Adjustment same as for preceding Section 1706.

STARTER: Four pole series wound machines with field coil on each pole.

Four brushes in two opposite pairs; top and bottom joined together, right and left joined together.

Field Circuit: On clockwise rotation machines (from drive end) two field coils between ungrounded terminal and right and left hand brushes, other two coils between top and bottom brushes and grounded terminal. On counter-clockwise machines (from drive end) two coils between ungrounded terminal and top and bottom brushes, other two coils between right and left hand brushes and grounded terminal.

Same care and setting for starting switch as for preceding Section 1706.

Torque Ft.-Lbs.	Type 8550, 6-volt			Type 8306, 6-volt			Type 8306, 12-volt		
	R. P. M.	Amp.	Volts	R. P. M.	Amp.	Volts	R. P. M.	Amp.	Volts
1	2300	95	5.8	2100	80	5.8	.....	.....	.....
2	1750	140	5.5	1650	125	5.6	2400	80	11.1
3	1360	190	5.1	1400	160	5.4	1950	102	10.7
4	1100	228	4.9	1190	195	5.2	1660	130	10.4
5	850	270	4.7	1010	230	5.0	1450	152	10.1
6	600	310	4.4	900	255	4.9	1260	180	9.9
7	.....	.....	.....	770	280	4.8	1110	200	9.6
8	.....	.....	.....	620	310	4.6	980	220	9.4
10	.....	.....	.....	.....	.....	.....	740	260	8.9

DIAGRAMS: For generators, see Diagrams 1759 and 1761.
For motors, see Diagrams 1758 and 1760.

REMY

TWO POLE GENERATORS, THIRD BRUSH, 6 VOLT

MODELS: O, OB, OD, OF, OJ, 10, 11, 12, 13, 14, 17, 165.

VOLTAGE: 6.

CHARGE RATES:

Model	Maximum Output		Amperes at 2000 R. P. M.	Revolutions per Minute for Output of		
	Amperes	R. P. M.		7-Amp.	10-Amp.	12-Amp.
O, OB, OJ	16	1200	12	550	700	800
OD, OF	16.2	1450	11-15	475	560	675
10, 11, 17	12	1250	8-10	625	850	1250
12	16	1200	12	550	700	800
13, 14	14	1100	8-13	550	675	820
165	16	1200	12	500	590	680

REGULATION: Third brush controls field current and output. Charge rate may be slightly higher with fully charged battery or lower with discharged battery.

The third brush has a stationary mounting and in order to change the point of contact and alter the output it is necessary to file off one side or the other, filing away the part of the brush that makes contact with the commutator but not that part in the holder. Filing off the left hand side moves the contact to the right; filing off the right hand side moves the contact to the left.

To increase the output, file off the side of the brush that is away from the nearest (trailing)main brush, thus moving the contact closer to the main brush. To decrease the output file off the side of the third brush that is nearest the main (trailing) brush. File only a very little at one time, then replace the brush and test the output.

GENERATOR: Two pole machine with single shunt field coil carried above the armature. Two main brushes and one regulating brush. Regulating brush may be below main brush on either side or above main brush on right hand side.

Field Currents:

Models		
O, OB, OJ, 12	1.7 amperes	6.0 volts
OD, OF	1.3 amperes	6.5 volts
10, 11, 17	1.8 amperes	6.2 volts
13, 14	5.2 amperes	6.5 volts
165	2.0 amperes	6.3 volts

CUT-OUT: Magnetic, mounted on generator above commutator.

Cut-in speeds:

Models	
O, OB, OJ, 165	350 R. P. M.
OD, OF, 10, 11, 17	300 R. P. M.
13, 14	375 R. P. M.

Cut-outs open with discharge of 0.5 to 1.5 amperes.

Cut-in speed adjusted by altering air gap between magnet and armature with contacts open. Normal gap .025 to .030 in. Normal contact point opening .017 to .020 in.

Opening discharge adjusted by altering spring tension. This is done by bending the spring under the armature.

STARTER: See Section 2041 on Remy Starting Motors.

DIAGRAMS: See Diagrams 2051, 2053 and 2068.

REMY

MODELS M AND MJ GENERATORS

VOLTAGE: 12.

CHARGE RATE: With all lamps turned off—

3.5 amperes at ..... 500 R. P. M.
4.5-6.5 amperes at ..... 2000 R. P. M.

GENERATOR: Field core carries four windings; shunt, reversed series, and load coils. Two brushes set at opposite points on commutator. Terminals and field circuits shown on internal wiring diagram 2083.

REGULATION: Reversed series and load windings on field core. No adjustment other than slight effect secured by altering brush tension.

CUT-OUT: Magnetic, mounted on generator. Closes at 400 R. P. M. Opens with 0.5 to 1.0 ampere discharge. Contact point gap should be .020 to .025 in. with cut-out open.

STARTER: See Section 2041 on Remy Starting Motors.

DIAGRAM: See Diagram 2083.

REMY

MOTOR-GENERATOR, ROUND FRAME, 12 VOLT

MODELS: 120, 129A, 129B.

VOLTAGE: 12.

CHARGE RATE:

Cuts-in	1050-1140 R. P. M.	12.0-13.5 volts
5 amperes	1200-1350 R. P. M.	14.0-14.5 volts
7.5 amperes	1250-1450 R. P. M.	14.5-15.0 volts
6.5-11.0 amperes	6000 R. P. M.	14.0-15.0 volts

MOTOR-GENERATOR: Four pole machine with shunt and starting series windings on each pole piece. Four brushes connected in opposite pairs. Single armature for both charging and starting.

Test Terminals: Ammeter between large negative terminal on motor-generator and cable removed. (Engine to be cranked by hand.) Voltmeter between large positive terminal on motor-generator and large negative terminal or ground.

Field Terminals: Series field winding (for two poles) between large positive terminal and positive brush ring; for other two poles between large negative terminal and negative brush ring. Shunt field winding between (small) shunt terminal on motor-generator and negative brush ring.

REGULATION: Vibrating type regulator inserting field resistance for constant current at all speeds above regulation point. The contacts used on the regulator side of the instrument are protected by a condenser shown in the wiring diagram.

The maximum charge rate is increased by increasing the regulator spring tension and decreased by lessening the spring tension.

Before adjusting the spring tension, raise or lower the stationary contact supports until the end of the armature stands slightly above the end of the magnet core. Then press lightly on the center of the armature and note whether both pairs of contacts separate at the same instant. If they do not, adjust one of the stationary contact supports up or down until both pairs separate at once.

The spring tension is adjusted by turning the small screw in the center of the armature in or out. In some cases it may be necessary to bend the armature tension spring slightly.

CUT-OUT: Magnetic in same housing with regulator.

Closes at 1100-1200 R. P. M., 12.4 to 12.6 volts.

Opens with discharge of 0.0 to 1.0 amperes.

With contact points closed, gap between end of core and armature to be .012 to .015 in.; adjusted by moving stationary contact point up or down.

With contact points separated their gap should be .017 to .020 in.; this being fixed by the stop pin passing through the armature which can be raised or lowered slightly.

Armature spring tension is adjusted by backing out the adjusting screw in the center of the armature.

STARTER:

Running free	1100-1200 R. P. M.	6- 10 amperes	12.0-13.0 volts
8 Lbs. pull, 6-in. pulley	900-1000 R. P. M.	20- 30 amperes	11.4-11.8 volts
12 Lbs. pull, 6-in. pulley	800- 900 R. P. M.	30- 40 amperes	11.3-11.5 volts
20 Lbs. pull, 6-in. pulley	600- 700 R. P. M.	40- 50 amperes	10.5-10.8 volts
32 Ft.-Lbs	locked	300-350 amperes	10.0 volts

DIAGRAM: See Diagram 2056.

REMY

DOUBLE DECK MOTOR AND GENERATOR, CURRENT REGULATOR TYPE

MODELS: 150, 159.

VOLTAGE: 150 is a 6 volt machine, 159 is a 12 volt machine.

CHARGE RATES: Model 150:

0.0 amperes	525- 600 R. P. M.	6.2-6.4 volts
7.5 amperes	750- 825 R. P. M.	6.8-7.0 volts
13.5 amperes	950-1050 R. P. M.	7.2-7.4 volts
13.0 amperes	4000 R. P. M.	

Model 159.

0.0 amperes	350- 400 R. P. M.	13.5 volts
2 amperes	450- 550 R. P. M.	13.5 volts
4 amperes	630- 700 R. P. M.	13.9 volts
6.5 amperes	1450-1700 R. P. M.	14.2 volts
6 amperes	2200-3000 R. P. M.	

GENERATOR: Shunt wound, field coils on two poles, two poles consequent. Four main brushes connected in opposite pairs, one pair positive, other negative. Generator and motor are set in same frame casting but otherwise are separate units; each having its own armature, fields, and pole pieces.

Test Terminals: Ammeter between either the positive or negative generator terminal and wire removed. Voltmeter between positive and negative generator terminals.

Field Terminals: Shunt field winding between "F" or "Fld" terminal (sometimes grounded) and brush ring.

REGULATION: Vibrating type regulator inserting field resistance for constant current at all speeds above regulation point.

The maximum charge rate is increased by increasing the regulator spring tension and decreased by lessening the spring tension.

Before adjusting the spring tension, raise or lower the stationary contact supports until the end of the armature stands slightly above the end of the magnet core. Then press lightly on the center of the armature and note whether both pairs of contacts separate at the same instant. If they do not, adjust one of the stationary contact supports up or down until both pairs separate at once.

The spring tension is adjusted by turning the small screw in the center of the armature in or out. In some cases it may be necessary to bend the armature tension spring slightly.

CUT-OUT: Magnetic, in same housing with regulator.

Closing:	Model 150	575-650 R. P. M.	7.0- 7.5 volts
	Model 159	400-450 R. P. M.	13.5-14.0 volts

Opens with discharge of 0.0 to 1.0 amperes.

With contact points closed, gap between end of core and armature to be .012 to .015 in.; adjusted by moving stationary contact point up or down.

With contact points separated their gap should be .017 to .020 in.; this being fixed by the stop pin passing through the armature. The pin can be raised or lowered slightly.

Armature spring tension is adjusted by backing out the adjusting screw in the center of the armature.

STARTER: Series wound, field coils on two poles, two poles consequent. Two field coils in series between one brush ring and terminal.

Torque 12-inch Pulley	Model 150			Torque 12-inch Pulley	Model 159		
	R. P. M.	Amperes	Volts		R. P. M.	Amperes	Volts
0, Free	300	40- 50	6.0	0, Free	280-300	20-25	13.0
16 Lbs.	175	80- 90	5.9	4 Lbs.	225-240	25-30	12.8
32 Lbs.	125	110-120	5.8	8 Lbs.	205-215	30-35	12.7
48 Lbs.	100	135-140	5.7	12 Lbs.	180-200	35-40	12.7
64 Lbs.	90	150-170	5.6	16 Lbs.	170-180	40-45	12.6
				18 Lbs.	160-170	45-50	12.6

DIAGRAMS: See Diagrams 2057 and 2058.

REMY

DOUBLE DECK MOTOR AND GENERATOR, THIRD BRUSH TYPE

MODELS: SLO, SL2, SL3.
151, 152, 153, 154, 155, 156, 157, 158.

VOLTAGE: 6.

CHARGE RATES:

Model	Maximum Output		Amperes at 2000 R.P.M.	Revolutions per Minute for Output of		
	Amps.	R. P. M.		7-Amp.	10-Amp.	12-Amp.
SLO	14	1500-1550	12.5-13	680- 780	900-1000	1100-1250
SL2	12-15	1500-2200	12.0-14	900-1200	1150-1500	1300-1800
SL3 Rutenber	14	1200-1600	11.0-13	600- 700	775- 900	950-1100
SL3 Teetor	16	1400-2000	14.5-15	825- 925	1000-1100	1100-1200
151 to 158	14	1500-1550	11.5-13	675- 700	850- 900	1175-1200

GENERATOR: Shunt wound, field coils on two poles, two poles consequent. Two main brushes set at 90 degrees angle. One regulating brush. Generator and motor are set in the same frame casting but are otherwise separate units, each with its own armature, fields, and pole pieces.

Test Terminals: Ammeter between either + or − generator terminal and wire removed. Voltmeter between + and − generator terminals.

Field Terminals: Shunt field winding between "F" or "Fld" terminal and third brush.

Field Current:

Models SLO, 151 to 158 ..... 2.0 amperes at 6.8 volts
Models SL2, SL3 Rutenber ..... 1.8 amperes at 6.2 volts
Model SL3 Teetor ..... 2.5 amperes at 6.1 volts

REGULATION: Third brush controls field current and output. Charge rate may be slightly higher with fully charged battery or lower with discharged battery.

Third brush adjustable for raising or lowering charge rate.

CUT-OUT: Magnetic, mounted as separate unit.

Closing: SLO, 151 to 158 ..... 500-550 R. P. M., 7.0-7.5 volts
SL2 ..... 600-700 R. P. M., 7.0-7.5 volts
SL3 Rutenber ..... 450 R. P. M., 7.0-7.5 volts
SL3 Teetor ..... 575-700 R. P. M., 7.0-7.5 volts

Opens with discharge of 0.5 to 1.5 amperes.

With contact points closed, gap between end of core and armature to be .012 to .015 in.; adjusted by moving stationary contact point up or down.

With contact points separated their gap should be .017 to .020 in.; this being fixed by the stop pin passing through the armature. The pin can be raised or lowered slightly.

Armature spring tension is adjusted by backing out the adjusting screw in the center of the armature.

STARTER: Series wound, field coils on two poles, two poles consequent. Two field coils in series between one brush ring and terminal.

Torque 12-inch Pulley	SL2			SL3 Teetor		
	R. P. M.	Amperes	Volts	R. P. M.	Amperes	Volts
0 Lbs.	375-425	75- 85	5.6	310-350	60- 65	5.8
16 Lbs.	225-260	135-150	5.4	185-200	100-115	5.5
32 Lbs.	175-200	200-220	4.8	145-160	135-150	5.3
64 Lbs.	100-120	300-325	4.0	85-100	200-220	4.8

Torque 12-inch Pulley	SLO, 151-158			SL3 Rutenber		
	R. P. M.	Amperes	Volts	R. P. M.	Amperes	Volts
0 Lbs.	210-240	25- 45	5.9	210-240	34- 45	5.9
16 Lbs.	115-120	65- 75	5.4	115-130	65- 75	5.4
32 Lbs.	90-100	85- 95	5.3	90-110	85- 95	5.3
48 Lbs.	70- 80	100-115	5.2	70- 80	100-115	5.2
64 Lbs.	60- 70	120-130	5.0	60- 70	120-130	5.0
80 Lbs.	50- 60	135-150	4.8	50- 60	135-150	4.8

DIAGRAMS: See Diagrams 2055 and 2059.

REMY

ROUND GENERATORS WITH CURRENT REGULATOR

MODELS: 16, 18
161, 166, 168.
240, 241, 242, 243, 245, 247, 249, 255.

VOLTAGE: 6.

CHARGE RATES:

Model	R. P. M. at 7 Amperes	Maximum Output	
		Amperes	R. P. M.
16A, B, C	490	14.2	2200
18A, B	490	14.2	2200
18C, D	510	14.5	1450-2000
161A, B, C, D	780-850	14.5	2500-3000
166A, B, C	780-850	14.5	2500-3000
168A, B, C, D	780-850	14.5	2500-3000
168E	680-750	14.5	2400-2900
240A	500	12.5	1500
241A	700	12.5	2500
242A	800-850	13-14	1500-3000
243A, B	800-850	13-14	1500-3000
243C, D, E, F	600-650	13-14	1500-3000
245A, B, C	700-750	13-14	1500-3000
245D	800	13-14	1500-3000
245E, F, G	700-750	13-14	1500-3000
247A	500	14	1500-2000
249B, C, D	800-850	10	1400
255A, B	680-750	14	2400-2900

GENERATOR: Four pole, shunt wound, four field coils. Three brushes; two negative brushes at opposite sides of commutator and both grounded (except on Models 240 and 241). One positive brush with lead to relay-regulator (cut-out). Model 16C has two positive brushes opposite each other and connected with each other.

Test Terminals: Ammeter between wire from generator to fuse on relay-regulator and the fuse terminal on the relay-regulator. Voltmeter between wire from generator to fuse on relay-regulator and ground.

Motoring Current:

Models 16, 18A, B ..... 4 -4.5 amperes, 5.8 volts, 430 R. P. M.
Models 18C, D ..... 4 -4.5 amperes, 5.8 volts, 420 R. P. M.
Model 161 ..... 4.5-5 amperes, 5.8 volts, 430 R. P. M.
Model 166 ..... 5.5 amperes, 5.8 volts, 470 R. P. M.
Models 168A, B, C, D ..... 5.5 amperes, 5.7 volts, 420 R. P. M.
Model 168E ..... 5.5 amperes, 5.9 volts, 400 R. P. M.
Model 240 ..... 3 -4 amperes, 5.8 volts, 240 R. P. M.
Model 241 ..... 3 -4 amperes, 5.8 volts, 390 R. P. M.
Models 242, 243A, B ..... 5.6 amperes, 6.0 volts, 400 R. P. M.
Models 243C, D, E, F ..... 5.5 amperes, 6.0 volts, 410 R. P. M.
Models 245A, B, C, E, F, G ..... 6 -6.5 amperes, 5.8 volts, 470 R. P. M.
Model 245D ..... 5 -5.5 amperes, 5.8 volts, 400 R. P. M.
Model 247 ..... 4.0 amperes, 5.8 volts, 420 R. P. M.
Model 249 ..... 4.2 amperes, 6.2 volts, 240 R. P. M.
Model 255 ..... 5.5 amperes, 5.9 volts, 400 R. P. M.

Field Terminals: Shunt field between negative brush (grounded) and line leading to field terminal on relay-regulator.

Field Current:

Models 16, 18 ..... 3.0-3.4 amperes, 5.9 volts
Model 161 ..... 3.5-4.0 amperes, 5.9 volts
Model 166 ..... 4.0 amperes, 6.0 volts
Model 168 ..... 4.0 amperes, 5.9 volts
Models 240, 241 ..... 2.0 amperes, 5.9 volts
Models 242, 243A, B ..... 3.7 amperes, 6.1 volts
Models 243C, D, E, F ..... 3.7 amperes, 6.0 volts
Model 245 ..... 3.5-4.0 amperes, 5.9 volts
Model 247 ..... 3.0-3.5 amperes, 5.9 volts
Model 249 ..... 2.0 amperes, 6.0 volts
Model 255 ..... 4.0 amperes, 5.9 volts

REGULATION: Vibrating type regulator inserting field resistance for constant current at all speeds above regulation point.

The maximum charge rate is increased by increasing the regulator spring tension and decreased by lessening the spring tension.

Before adjusting the spring tension, raise or lower the stationary contact supports until the end of the armature stands slightly above the end of the magnet core. Then press lightly on the center of the armature and note whether both pairs of contacts separate at the same instant. If they do not, adjust one of the stationary contact supports up or down until both pairs separate at once.

The spring tension is adjusted by turning the small screw in the center of the armature. In some cases it may be necessary to bend the armature tension spring slightly.

REMY

ROUND GENERATORS WITH CURRENT REGULATOR—*Continued.*

CUT-OUT: Magnetic, in same housing with regulator.

Closing: 6.4 to 6.6 volts at following speeds—

Models 16; 18A, B	at 400	R. P. M.
Models 18C, D	at 420	R. P. M.
Models 161; 166; 168A, B, C, D; 242; 243A, B; 245A, B, C, E, F, G	at 660-700	R. P. M.
Models 168E; 243C, D, E, F; 255	at 560-600	R. P. M.
Model 240A	at 400	R. P. M.
Model 241A	at 600	R. P. M.
Model 245D	at 730	R. P. M.
Model 247A	at 400	R. P. M.
Model 249	at 625-700	R. P. M.

Opens with discharge of 0.0 to 1.0 amperes.

With contact points closed, gap between end of core and armature to be .012 to .015 in.; adjusted by moving stationary contact point up or down.

With contact points open, their gap should be .017 to .020 in.; this being fixed by the stop pin passing through the armature. The pin can be raised or lowered slightly.

Armature spring tension is adjusted by turning the adjusting screw in the center of the armature.

STARTER: See Section 2041 on Remy Starting Motors.

DIAGRAMS: See Diagrams 2061, 2064, and 2075.

REMY

ROUND FOUR POLE GENERATORS, THIRD BRUSH

MODELS: 251, 252.

VOLTAGE: 251 is a 6 volt machine, 252 is a 12 volt machine.

CHARGE RATES:

Model 251			Model 252		
Amperes	Revolutions per Minute	Volts	Amperes	Revolutions per Minute	Volts
0	600	6.2	0	400	12.1
7	800	6.4	6	660	13.0
12-13	1300-1500	6.8	9.5	1100	13.8
10-12.5	2000	6.7	6.7	2000	13.5
8-10	3000	6.6	5	3000	13.2

GENERATOR: Four pole, shunt wound. Four field coils. Two main brushes at 90 degrees from each other, one regulating brush.

Test Terminals: Ammeter between generator terminal and wire removed. Voltmeter between generator terminal (negative) and ground.

Shunt field between generator terminal (negative) and third brush (positive).

Field current, Model 251, 4.0 amperes at 6.0 volts. Field current, Model 252, 2.5 amperes at 12.3 volts.

Motoring Current: Model 251, 300 R. P. M. with 4.7 amperes at 6 volts. Model 252, 340 R. P. M. with 3.5 amperes at 12.3 volts.

REGULATION: Third brush controls field current and output. Charge rate may be slightly higher with fully charged battery or lower with discharged battery.

Third brush mounted on adjustable bracket. Moving anti-clockwise increases output; moving clockwise decreases output.

CUT-OUT: Magnetic, mounted separately.

Cut-in speed: Model 251.....675 R. P. M., 7.0- 7.4 volts
Model 252.....490 R. P. M., 13.5-14.0 volts

Cut-out opens with discharge of 0.0 to 1.0 amperes.

Air gap between end of magnet core and armature .012 to .015 in. with contacts closed. Contact point opening should be .012 to .015 in.; adjusted by bending the armature stop up or down. Spring tension is adjusted by bending the brass strip through which the spring passes.

STARTER: See Section 2041 on Remy Starting Motors.

DIAGRAM: See Diagram 2066.

REMY

ROUND GENERATORS, THERMOSTAT CONTROL, THIRD BRUSH

MODELS: 230, 231, 232, 233, 234, 237, 239, 248, 254, 256, 257, 258. 910, 911, 912, 913, 915, 917, 919, 920, 931, 933, 935.

VOLTAGE: 6.

CHARGE RATES:

Models	With Thermostat Closed								Thermostat Open, Maximum Amperes
	Maximum Output		Amperes at R. P. M. of		R. P. M. Giving Output Of				
	Amp.	RPM	2000	2500	7-a	10-a	12-a	15-a	
230A, B	22	1800	20	17	745	850	925	1060	8-10
231A, B	21.5	1700	20	13.7	630	700	800	950	12-14
232A	22	1800	20	17	745	850	925	1060	8-10
233A	20.5	1680	19-20	16-17	780	910	1020	1180	12-14
234A, C	20.5	1680	19-20	16-17	780	910	1020	1180	7-8
234B	22	1800	20	17	745	850	925	1060	8-10
237A	16	1650	14-15	9-10	800	940	1080	1350	6-9
239A	14-16	1400	13-15	10-12	850	1000	1150	1300	6-9
248A, B	22	2150	21	21	850	1000	1100	1250	8-10
250A	20	1700	18-20	15-17	800	925	1050	1200	8-10
254	18-20	1500	18	15	510	590	650	775	13-14
256A	18-20	1500	18	15	510	590	650	775	13-14
257A, B, C, D, E	20	1400	16-19	12-15	590	700	760	900	13-14
258A	20	1400	16-19	12-15	590	700	760	900	13-14
910A	19-21	1800	18.5	17-18	800	950	1050	1200	6-9
911A	19-21	1800	18.5	17-18	800	950	1050	1200	6-9
912A	19-21	1800	18-20	17-19	825	925	1040	1225	6-9
913A, B	19-21	1800	18.5	17-18	800	950	1050	1200	6-9
913C, D, E, F	19-21	1800	18-20	17-19	825	925	1040	1225	6-9
915B	18-20	1800	17-19	14-17	850	950	1050	1250	6-9
916A, B	18-20	1800	19-20	16-18	850	975	1075	1375	6-9
917A, B	18-20	1800	17-19	14-18	850	1000	1125	1325	10-14
917C	13-14	1600	12-13	12-13	800	850	1100	.....	6-9
917D, E	18-20	1800	17-19	10-17	850	950	1050	1250	6-9
919A	19-21	1800	18-20	17-19	825	925	1040	1225	6-9
920A	20	1350	16-19	12-15	600	700	775	1000	6-9
920B	19-21	1300	16-18	14-15	600	700	760	900	6-9
931A	18-20	1800	17-19	14-18	850	960	1080	1300	6-9
933A	18-20	1800	17-19	14-18	850	960	1080	1300	6-9
935A	18-20	1800	17-19	14-18	850	960	1080	1300	6-9

GENERATOR: Two pole, shunt wound, two field coils. Two main brushes set opposite each other with third brush between them. The position of the third brush depends on the type of generator; it may be above or below the main brushes and on either the right hand or left hand side.

Test Terminals: Ammeter between line from ungrounded main brush to cut-out and the terminal for this line or the cut-out contact. Voltmeter between above mentioned line and ground.

Field Terminals: Shunt field between third brush and thermostat.

Field Current:

Models 230, 231, 232, 233, 234, 237.....5.0 amperes at 6.4 volts
Models 239, 917A, B, 920B.....5.0 amperes at 6.0 volts
Model 248.....3.8 amperes at 6.2 volts
Models 250, 254, 256.....5.0 amperes at 5.4 volts
Models 257, 258.....3.5 amperes at 6.8 volts
Models 910, 911, 913A, B.....5.5 amperes at 6.0 volts
Models 912, 913C, D, E, F, 915, 916, 917C, D, E.....4.8 amperes at 6.0 volts
Model 920.....6.0 amperes at 6.0 volts
Models 931, 933, 935.....5.7 amperes at 6.0 volts

REGULATION: Third brush controls field current and charge rate as long as the thermostat contacts remain closed with the generator temperature below 175° F. With the thermostat contacts open, at higher temperatures, the charge rate is reduced, although its rise and fall with change of speed is still regulated by the third brush action.

Adjustment of the charge rate is made by moving the third brush, this adjustment being made only with the generator cool and with the thermostat contacts closed. The third brush is mounted on a rotating bracket having a toothed sector with which meshes a small pinion. The position is altered by turning a small screw on the commutator-end head of the generator, this screw operating the pinion and brush bracket.

THERMOSTAT: Thermostat is placed over generator commutator with a resistance unit shunted across its contact points, the whole being in series with the shunt field winding. Thermostat consists of a stamped steel bracket carrying the resistance unit connected to the bracket. The thermo blade has a stationary contact attached and an adjustable screw silver contact point whose position is fixed with a soldered sealer. Time of opening depends on atmospheric conditions and battery charge.

REMY

ROUND GENERATORS, THERMOSTAT CONTROL, THIRD BRUSH—*Continued*

Some machines carry a field fuse between the thermostat and the ground connection. In those without this fuse, the thermostat resistance serves also as a field fuse and will burn out under the same conditions that would cause a field fuse to blow. With a burned out resistance, the ammeter indication will drop to zero when the contacts open, returning to the full charge rate when they close. A new resistance or new thermostat unit should be installed immediately to prevent damage to the contacts.

The thermostat adjustment is destroyed by excessive dressing of the contacts or by prying them apart.

CUT-OUT: Magnetic, mounted on generator frame or as a separate unit.

Closing: 7.0 to 7.4 volts at following speeds—

Models 230, 232, 234B at ..... 600 R. P. M.
Model 231 at ..... 500 R. P. M.
Models 233, 234A, C at ..... 610 R. P. M.
Models 237, 239, 916, 917C at ..... 550 R. P. M.
Models 248, 250 at ..... 670 R. P. M.
Models 254, 256 at ..... 390 R. P. M.
Models 257, 258 at ..... 425 R. P. M.
Models 910, 911, 913A, B, 917A, B at ..... 600 R. P. M.
Models 912, 913C, D, E, F, 915, 917D, E, 919, 931, 933, 935 at ..... 675 R. P. M.
Model 920A at ..... 375 R. P. M.
Model 920B at ..... 500 R. P. M.

Opening with discharge of 0.5 to 2.0 amperes.

With contact points closed, distance between end of magnet core and armature to be .012 to .015 in.; adjusted by moving the stationary contact up or down, making sure that they meet squarely.

With contact points separated, distance between them should be .012 to .015 in.; adjusted by bending the armature stop up or down.

Armature spring tension is changed by bending the brass strip through which the spring passes.

STARTER: See Section 2041 on Remy Starting Motors.

DIAGRAMS: See Diagrams 2052, 2062, 2065, 2067, 2069, 2070, 2071, 2072, 2073, 2084, 2085, 2086.

REMY

THERMOSTAT REGULATED GENERATOR

MODEL: 238A.

VOLTAGE: 12.

CHARGE RATE: With all thermostats closed, straight shunt field test—

Cuts in	440 R. P. M.	12.8 volts
7 amperes	550 R. P. M.	14.0 volts
14 amperes	670 R. P. M.	15.1 volts
18 amperes	765 R. P. M.	15.7 volts

Regulator test—

With regulator mounted on generator, run machine at 25 amps. output, 16-17 volts; and output should drop to 15 amps. or less in 3 minutes or less.

After output drops to 15 amps. or less, speed generator up to 1600 R. P. M. for 5 minutes. At end of this run, output should be 8-12 amperes.

GENERATOR: Four pole, shunt wound, four field coils. Two main brushes set at 90 degrees from each other. Positive main brush lead runs through thermostat regulator to ground. Negative main brush lead to cut-out and to shunt field.

Test Terminals: Ammeter between generator terminal leading to cut-out and wire removed. Voltmeter between generator terminal leading to cut-out and ground.

Field Terminals: Shunt field winding between negative main brush and lead to thermostat resistances.

REGULATION: Multi-blade thermostat; no other regulation employed.

Thermostat mounted on brush cover ring. Consists of two rectangular steel brackets, each carrying two silver contact points; also four spring blades, each carrying a silver contact point making contact with those on brackets. Brackets are insulated from each other. Blades riveted to brackets through insulation washers. Blades provide continuous path through each blade in turn for current from positive main brush. Thermo blades open contacts at 190° F. The four silver points on blades are insulated from blades but are connected by metal ribbon conductors to ends of four resistance wires which are wound in parallel turns on two mica strips. One end of each resistance wire is connected through metal of bracket to one of four points mounted on brackets. Each open pair of contacts forces field current through corresponding resistance. Contact pairs open one after another with increase of heat. Closing and opening of contacts may cause pronounced fluctuation of ammeter, which does not indicate anything wrong. The thermostat adjustments are destroyed by dressing the contacts excessively or by prying them apart.

CUT-OUT: Magnetic, mounted as separate unit.

Closes at 440 R. P. M., 13.5 to 14.0 volts.

Opens with 0.5 to 1.5 ampere discharge.

With contact points closed, distance between end of magnet core and armature to be .012 to .015 in.; adjusted by moving the stationary contact up or down.

With contact points separated, distance between them should be .012 to .015 in.; adjusted by bending armature stop up or down.

Armature spring tension is changed by bending the brass strip through which the spring passes.

STARTER: See Section 2041 on Remy Starting Motors.

DIAGRAM: See Diagram 2076.

REMY

STARTING MOTORS

Model	Pounds Pull	Pulley Inches	R. P. M.	Amperes	Volts
4	free	.....	3800-5000	35-50	5.8-6.0
	4	6	1700-2000	105	5.6-5.8
5	free	.....	3600-4200	40-56	5.8-6.0
	8	6	1500-1800	150	5.3-5.4
6	free	.....	4300-5500	50-60	5.6-6.0
	8	6	1000-1800	150	5.4
9	free	.....	4500-6000	40-60	5.8-6.0
			2000-2400	140	5.3
110A	free	.....	3600-4200	40-56	6.0
	8	6	1500-1800	150	5.3-5.4
113A	free	.....	4500-6000	40-60	5.8-6.0
			2000-2400	140	5.3
114A	free	.....	3500-6000	36-50	.....
	16	6	1100-1450	190-220	.....
	40	6	200- 350	420-475	.....
	14 Ft.-Lbs.	.....	lock	520-600	.....
115A	free	.....	4500-6000	40-60	5.8-6.0
			2000-2400	140	5.3
116A	free	.....	3600-4200	40-56	6.0
	8	6	1500-1800	150	5.3-5.4
117A	free	.....	4000-4500	35-40	6.0
	8	6	1450-1600	120-140	4.9-5.2
	20	6	750- 900	225-250	4.6-4.9
118A	free	.....	3750-4250	32-40	6.0
	9	6	1200-1400	110-120	5.5-5.7
	16	6	800-1000	158-175	5.3-5.4
124A	free	.....	3600-4200	40-56	6.0
	8	6	1500-1800	150	5.3-5.4
126A	free	.....	4500	40	6.0
	8	6	1600	110	5.6
	24 Ft.-Lbs.	.....	lock	520	3.6
128A	free	.....	3600-4400	46-60	5.8-6.0
	8	6	1600-1800	120-140	5.4-5.6
	20	6	700- 800	340-360	4.3-4.6
	32 Ft.-Lbs.	.....	lock	500-650	3.4-3.6
180A, B, C, D	free	.....	3600-4000	55-65	6.0
	16	6	1200-1450	200-220	4.6
	40	6	300- 450	460-600	3.6
	14 Ft.-Lbs.	.....	lock	550-600	3.2
181A	free	.....	2000-2300	80-90	5.8-5.9
	9	6	1520-1650	100-120	5.0-5.5
	18 Ft.-Lbs.	.....	lock	500-550	
182A	free	.....	1400-1600	55-70	6.0
	8	6	920-950	95-120	5.5-5.6
	24	6	520-540	190-200	4.9-5.0
	40	6	300-400	250-270	4.5-4.6
	50 Ft.-Lbs.	.....	lock	520-550	3.2
183A	16	6	600-800	110-130	5.2
	24	6	500-600	130-170	5.0-5.1
	55 Ft.-Lbs.	.....	lock	640-660	3.2
184A	free	.....	3600-4200	56-64	6.0
	24	6	850-950	290-310	4.5-4.6
	40	6	300-400	450-500	3.5-3.6
	14 Ft.-Lbs.	.....	lock	570-600	3.0
185A, B	8	6	650-900	65-80	5.8-5.9
	24	6	450-550	120-150	5.5-5.7
	40	6	350-400	175-200	5.3-5.5
	60 Ft.-Lbs.	.....	lock	580-620	4.0-4.2
186A	free	.....	3600-4200	56-64	6.0
	16	6	1200-1450	200-230	4.7-4.8
	40	6	300-450	450-500	3.5-3.6
	14 Ft.-Lbs.	.....	lock	570-600	3.0
187A	16	6	600-700	115-130	5.2
	24	6	500-600	150-170	5.1
	60 Ft.-Lbs.	.....	lock	590-620	2.9-3.2
188A	4	6	650-750	50-55	6.0
	16	6	450-500	85-95	5.7-5.8
	24	6	400-450	100-120	5.6-5.7
	50 Ft.-Lbs.	.....	lock	590-620	3.2
189A	free	.....	3600-4200	40-56	5.8-6.0
			1500	150	5.6
	20 Ft.-Lbs.	.....	lock	700-720	3.6
290B	free	.....	3300	60	6.0
	16	6	1000	270	4.0
	28	6	225	395	3.7
	40 Ft.-Lbs.	.....	lock	450	3.6
292A	free	.....	3300	60	6.0
	4	6	2400	110	5.7
	28	6	225	395	3.7
	40 Ft.-Lbs.	.....	lock	450	3.6
293A, B	4	6	1850	110-115	5.3-5.5
	12	6	1150	200-210	4.9-5.1
	20	6	700	275-285	4.4-4.6
	15 Ft.-Lbs.	.....	lock	550-575	3.3-3.4
294A, B, C, D	4	6	1400	95-105	5.4-5.5
	12	6	800	180-190	5.0-5.1
	20	6	550	225-265	4.6-4.8
	16 Ft.-Lbs.	.....	lock	510-540	3.4-3.6

REMY

STARTING MOTORS—*Continued*

Model	Pounds Pull	Pulley Inches	R. P. M.	Amperes	Volts
295A	free	.....	3300	60	6.0
	16	6	1000	270	4.6
	28	6	225	395	3.7
	40 Ft.-Lbs.	.....	lock	450	3.6
298A	free	.....	3850	45	6.0
	16	6	1070	195	5.0
	36	6	475	350	4.4
	60 Ft.-Lbs.	.....	lock	500	3.6
299A, B, C	4	6	1850	95-100	5.4-5.6
	12	6	1050	165-172	4.9-5.0
	20	6	750	220-230	4.5-4.7
	19 Ft.-Lbs.	.....	lock	550-575	3.3-3.4
300A, B	4	6	780	65	6.0
	24	6	460	120	5.7
	40	6	360	160	5.5
	68 Ft.-Lbs.	.....	lock	585	3.3
303A, B, C, D	4	6	1850	110-115	5.3-5.5
	12	6	1150	200-210	4.9-5.1
	20	6	700	275-285	4.4-4.6
	15 Ft.-Lbs.	.....	lock	550-575	3.3-3.4
304A	4	6	2000	90-100	5.4-5.6
	16	6	1000	220-225	4.7-4.9
	24	6	600	290-300	4.2-4.5
	15 Ft.-Lbs.	.....	lock	550-575	3.3-3.4
305A, B, C	4	6	2500	110-130	5.4-5.6
	12	6	1500	215-225	4.8-5.2
	20	6	650	325-335	4.3-4.5
	9 Ft.-Lbs.	.....	lock	540-560	3.5-3.7
306A	4	6	1850	110-115	5.3-5.5
	12	6	1150	200-210	4.9-5.1
	16	6	850	238-250	4.6-4.8
	15 Ft.-Lbs.	.....	lock	550-575	3.3-3.4
307A	4	6	2150	140-150	5.5-5.7
	12	6	1300	220-230	4.8-4.9
	20	6	750	300-310	4.1-4.3
	12.5 Ft.-Lbs.	.....	lock	570-590	3.5-3.6
308A	4	6	2200	98	5.4
	16	6	1070	215	4.7
	28	6	580	315	4.1
	59.2	6	lock	550	3.35
309A	2 Ft.-Lbs.	.....	1050	72-82	5.6-5.7
	8 Ft.-Lbs.	.....	470	172-179	5.1-5.2
	12 Ft.-Lbs.	.....	300	220-230	4.9-5.0
	20 Ft.-Lbs.	.....	lock	375-400	3.8-4.2
420A	free	.....	3300	60	6.0
	16	6	1070	195	5.0
	20	6	750	225	4.6
	18 Ft.-Lbs.	.....	lock	586	3.3

Model	Ft.-Lb.	R. P. M.	Amperes	Volts
700B	free	10000	65	6.0
	1	3000	145	5.4
	4	1000	310	4.5
	12	lock	600	3.0
700C	free	6000	65	5.0
	12	lock	600	3.0
701A	1	3000	145	5.4
	3	1500	260	4.8
	5	800	350	4.4
	12	lock	600	3.0
702A, B	free	6000	90	5.0
	12	lock	600	3.0
705A, B	free	2600	75	5.0
	22	lock	600	3.0
705C, D	free	3000	75	5.0
	22	lock	600	3.0
710A	free	6000-10000	65	5.0
	1	3000	155	5.2
	4	1200	330	4.4
	9.5	lock	575	3.1
715A, B	free	2600	75	5.0
	18	lock	600	3.0
720A, B, C	free	6000	60	5.0
	15	lock	570	3.15
721A	free	6000	60	5.0
	16	lock	570	3.15
735A, B, C	5	500	120-160	5.2
	15	240	215-275	4.6
	25	120	290-360	4.2
	55	lock	500-600	3.0
736A	free	900	75	5.0
	55	lock	600	3.0
740A, B, C, D, E	free	6000	65	5.0
	22	lock	600	3.0
741A, B	free	2000	75	5.0
	66	lock	600	3.0

Diagrams: See Diagrams 2063, 2077, 2078, 2079, 2080, 2081, 2082.

RUSHMORE

GENERATORS WITH IRON WIRE CONTROL

NUMBERS: 1, 2, DSR3.

VOLTAGE: 6 or 12 volts for 1 and 2, 12 volts for DSR3.

CHARGE RATES:

Generator Number	Speed, R. P. M.	6-Volt	12-Volt
1	1000-1200	12 amperes	6 amperes
1	1800-2000	16 amperes	8 amperes
2	600- 800	15 amperes	8 amperes
2	1000-1200	18 amperes	9 amperes
DSR3	600- 800	.....	7 amperes
DSR3	1000-1200	.....	9 amperes

GENERATOR: Two pole shunt wound machine with two field coils, one above armature and the other below.

Two brushes on opposite sides of commutator.

For machines with cut-out on generator—

Looking at the drive end of the machine, the two terminals on this end are numbered 1 and 2, right to left. Looking at the commutator end the three terminals in front of the cut-out are numbered 6, 8, 5 from left to right.

Test Terminals: Ammeter between terminal 6 and wire removed. Voltmeter between terminals 1 and 6.

Field Terminals: Shunt field windings between terminals 2 and 8 (shunt winding of cut-out also in circuit). Series fields between terminals 1 and 2.

For machines with separate cut-out—

Test Terminals: Ammeter between terminals 4 and wire removed. Voltmeter between terminals 1 and 4.

Field Terminals: Shunt field between terminals 2 and 5. Series field between terminals 1 and 2.

Shunt field current 1.25-1.50 amperes.

Field fuse of 4-ampere capacity carried on switch block.

REGULATION: In parallel with the reversed series field winding is a "ballast" coil wound with iron wire and carried in the switch unit. Charging current from the positive brush normally passes through the iron wire of the ballast without exciting the reversed series field and the machine operates practically as a straight shunt generator. When the charging current reaches a certain value (depending on the gauge of iron wire on the ballast) this wire heats up and its resistance increases to such a degree that the charging current is forced through the reversed series field, thus reducing the output. The ballast coil usually acts at about 15 miles an hour.

All ballast coils carry ten inches of iron wire, the gauge varying. On the end of the coil will be found marks similar to 10/20, indicating 10 inches of No. 20 gauge. The heavier the gauge used, the greater will be the output; while smaller wire will reduce the output at which the ballast acts. Change of output is secured by changing the ballasts.

With the head lamp switch mounted on the switch block, the ballast coil is open circuited when the head lamps are off, thus forcing all the charging current through the reversed series field and keeping the output down to 3-4 amperes.

CUT-OUT: Magnetic, carried on commutator end of generator or as separate unit.

Closes at 6.5-7.0 volts; opens with discharge of 0.0-2.0 amperes.

Spring tension is changed by bending the flat spring underneath the armature with flat nosed pliers. The armature gap is adjusted by turning the screw that passes through the armature back of the pivot bearings.

STARTER: Four pole series wound motor with four field coils and four brushes.

The armature shaft, on the end of which is carried the pinion meshing with the flywheel, is free to move endwise in its bearings and in the idle position the armature is held out of line with the pole pieces by a long coiled spring in the commutator end of the armature shaft. In this position the pinion is out of mesh with the flywheel gear.

The starting current excites the fields and armature and draws the armature and shaft against the tension of the spring and into line with the pole pieces, thus meshing the pinion.

The starting switch has three contacts. On the first one the circuit between battery and motor is open. As the contactor is pressed down to the second contact, battery current flows through a resistance on the switch. From the switch, most of the current goes through a line from the first contact through the motor fields and very little through the armature. This draws the armature endwise and rotates it slowly to facilitate gear meshing. The final movement of the switch cuts out the resistance and the auxiliary lead that carried current to the fields, the motor then cranking the engine as a regular series wound machine.

DIAGRAMS: See Diagrams 2175, 2177, and 2178.

SIMMS-HUFF

MOTOR-GENERATOR, 6-12 VOLT SYSTEM

TYPES: HB and HK.

VOLTAGE: 6 for charging and lighting, 12 for starting.

CHARGE RATE: With regulator key on front of panel turned to "High."

Cuts in, 3.0 amperes	900 R. P. M.
7.0 amperes	1000 R. P. M.
11.0 amperes	1100 R. P. M.
15.0 amperes, maximum	1200 R. P. M. and above

MOTOR-GENERATOR: Six pole machine, shunt field windings on all six poles, series field windings on three alternating poles.

Six brushes attached to a ring composed of two copper pieces separated by insulation. Three alternate brushes are positive and connect to outer part of ring, three intermediate brushes are negative and connect to inner part of ring. Brushes are set at 60 degrees from each other.

Single armature with one winding and one commutator.

Test Terminals: Ammeter between terminal DYN + on bottom of forward end plate and the small wire removed from this terminal. Voltmeter between this terminal and ground.

Field Terminals: Shunt field windings between FIELD terminal on side of motor-generator housing and ground. Series fields; one field coil between each of the three negative brushes and ground.

Shunt field draws 1.0-1.4 ampere at 6.3 volts.

Motoring idle, draws 7.0 amperes at 6.0 volts with shunt fields connected.

REGULATION: Vibrating type regulator, combined with cut-out, controlling resistance in shunt field circuit.

On 1914 and 1915 systems the regulator-cut out is carried under the front seat of the car. The regulator contacts are at the left hand end (looking from terminal side) and short circuit a resistance coil when they are closed. This coil is in series with the shunt field and with contacts open it is in the field circuit. Regulator contacts and resistance connected between terminals F and D +. Increasing the tension on the regulator contact spring increases the maximum charge rate, lessening the tension lowers the rate.

On 1916 and 1917 systems the regulator-cutout is carried in the cowl unit with the fuses and lighting switch, either back of the lighting switch or at one end of the unit. The regulator contacts are at one end of the magnet and are normally held closed by a flat spring. The field resistance is connected between terminals FIELD and DYN + and the regulator contacts are also between these terminals so that the resistance (in series with the shunt field) is short circuited with the contacts closed. The free end of the spring is held by a lip attached to the armature. Bending this lip down increases the spring tension and raises the maximum charge rate, bending it up lessens the spring tension and lowers the maximum rate.

The machine is driven by the fan belt when generating and the tension of the fan belt has a decided effect on the charge rate due to changes in speed between tight and loose belt. The belt should be just loose enough to allow slipping with the unit acting as a starter, yet tight enough to prevent appreciable slipping while generating.

The motor-generator operates as a reversed series machine while generating.

CUT-OUT: Magnetic combined with the regulator, using a single magnet core for both functions. Mounted under the front seat in 1914 and 1915 systems, in the cowl panel in 1916 and 1917 systems.

Closes at 7.5-8.0 volts, 2.0-3.0 amperes, 900 R. P. M.

Opens with discharge of 0.5-2.0 amperes.

Spring tension is increased by bending the spring support.

Increasing the spring tension raises the voltage of closing and lowers the amperage of opening. Lessening the spring tension lowers the closing voltage.

Cut-out contacts on unit under seat are between terminals D+ and B+; on cowl unit with ammeter they are between terminal DYN+ and the ammeter; on cowl unit without ammeter they are between terminals BAT+ and DYN+.

SIMMS-HUFF

MOTOR-GENERATOR, 6-12 VOLT SYSTEM—*Continued*

STARTER: The machine operates as a compound wound motor and is geared to the flywheel with a sliding pinion.

The starting switch case has six internal contacts and a sliding member which is moved from one end to the other to change the voltage for starting. There are also two ignition wire terminals on the switch cover which send battery current through the magneto while the engine is being cranked.

In the running position the two positive leads from the battery are connected through the switch sliding or rocking member and a bus bar inside the switch to the terminal connected to the ammeter or BAT+ terminal on the cowl unit, thence to the motor-generator terminal DYN+ on forward end plate of motor-generator. One negative terminal of the battery is directly grounded, while the other is grounded through the starting switch. With the two halves of the battery thus connected in parallel, charging and lighting is at 6 volts.

In the starting position current flows from one battery positive terminal through the starting switch to the large cable leading to the motor-dynamo, through the brushes, armature and series coils of the motor-generator to ground, then to the grounded negative terminal on the battery, through one half the battery, the starting switch, the other half of the battery to the positive terminal starting point. This places the two halves of the battery in 12 volt series for cranking.

Starter develops 4 ft.-lbs. (minimum) torque at 750 R. P. M. (minimum) with maximum of 60.0 amperes at 12.0 volts. Delivers 18 ft.-lbs. torque when locked.

DIAGRAMS: See Diagram 2251 and 2253.

SIMMS-HUFF

MOTOR-GENERATOR, STRAIGHT 12 VOLT SYSTEM

TYPES: M, HM, and SMS.

VOLTAGE: 12.

CHARGE RATE:

Cuts in, 1.5 amperes	1300 R. P. M.
3.0 amperes at	1400 R. P. M.
4.7 amperes at	1500 R. P. M.
6.2 amperes at	1600 R. P. M.
7.5 amperes, maximum	1700 R. P. M. and above

MOTOR-GENERATOR: Same construction as for preceding section. Field Current 1.3-1.4 amperes at 6.3 volts.

REGULATION: Same as for 1916 and 1917 systems in preceding section.

CUT-OUT: Closes 15.0-16.0 volts, 1300 R. P. M.; otherwise same as for 1916 and 1917 systems in preceding section.

STARTER: The starting switch is a single contact, single pole unit with an electromagnetic release operated from the lock button. The switch is operated through a plunger and this plunger is prevented from moving until a detent is withdrawn by the magnet. The magnet circuit is from the positive terminal of the battery, through the lock button switch, to and through the magnet on the starting switch and to the terminal of the starting switch connected by a heavy cable to the motor-generator.

Starter develops 4 ft.-lbs. (minimum) torque at 750 R. P. M. (minimum) with maximum of 60.0 amperes at 12.0 volts.
Types H and HM deliver a torque of 18 ft.-lbs. locked; type SMS delivers 16 ft.-lbs. torque locked.

DIAGRAM: See Diagram 2253.

SIMMS-HUFF

MOTOR-GENERATOR, STRAIGHT 12 VOLT SYSTEM, THIRD BRUSH REGULATION

TYPES: SMS-2 and SMS-3.

VOLTAGE: 12.

CHARGE RATE:

Cuts in, 1.0-1.6 amperes at	1400 R. P. M.	14.5 volts
3.0 amperes at	1650-1750 R. P. M.	
5.0 amperes at	1775-1925 R. P. M.	
8.0 amperes at	2250-2450 R. P. M.	
10.0-11.0 amperes at, maximum	3300-3500 R. P. M.	
9.0-10.0 amperes at	4000 R. P. M.	

MOTOR-GENERATOR: Six pole machine, shunt field windings on all six poles, series field windings on three alternating poles.

On type SMS-2 there are six main brushes attached to a compound brush ring composed of positive and negative metal rings separated by insulation, the three positive alternate brushes being attached to the positive (outside) ring, while the three intermediate negative brushes are attached to the negative (inside) ring. A brush for regulation is carried between one of the positive brushes and a negative main brush, but is not attached to the main brush rings. One series field coil is connected between each of the three negative brushes and ground. The shunt field coils are connected between the regulating brush and the terminal on the side of the field housing which is grounded. The shunt fields are connected in two sets, three coils in series in each set, and the two sets in parallel between the regulating brush and ground.

On type SMS-3 there are four main brushes attached to a brush ring composed of positive and negative metal rings separated with insulation. The two positive brushes are attached to the positive ring, the two negative brushes are connected to the negative ring. Positive and negative brushes alternate and are set 60 degrees from each other. The regulating brush is set opposite one of the negative main brushes, on a positive point of the commutator, but this brush is not connected to the brush rings.

One series field coil is connected between one of the negative brushes and ground. The other two series field coils have one end attached to the other negative brush and the other end grounded. Because all of the negative brushes and all of the series field coils are connected through the brush ring, the three brushes and three coils are in series-parallel.

The shunt field coils are connected in two sets, three coils in series in each set, and the two sets in parallel between the regulating brush and ground.

Test Terminals: Ammeter between terminal on bottom of forward end plate and wire leading to the cut-out. Voltmeter between this terminal and ground.

Field Terminals: See foregoing description of the two types.

REGULATION: Regulating brush controls field current and output. This regulating brush is positive and moving it toward the nearest positive main brush increases the charge rate, moving it away from that main brush lowers the rate. If the brush is already exactly on a positive point of the commutator, no matter which way it is moved, the charge rate will be lowered.

CUT-OUT: Magnetic, mounted on the motor-generator. Closes at 1400 R. P. M., 14.5 volts; opens with discharge of 0.0-1.5 amperes.

Increasing the spring tension by bending the arm raises the voltage and speed of closing and lowers the amperage of discharge for opening. Lessening the spring tension lowers the voltage and speed of closing and raises the amperage for discharge.

STARTER: The machine operates as a compound wound starting motor. The starting switch is a single pole, single contact type.

Starter develops 4 ft.-lbs. (minimum) torque at 650 R. P. M. (minimum) with maximum of 60 amperes and 12.0 volts. Delivers 16 ft.-lbs. torque when locked.

DIAGRAMS: See Diagrams 2255, 2256, and 2257.

SIMMS-HUFF

SEPARATE UNITS, THIRD BRUSH REGULATION

TYPES: G generator, B motor.

VOLTAGE: 6.

CHARGE RATE:

630-650 R. P. M. . cuts in	1400 R. P. M. . . . . 15.0-17.0 amperes
800 R. P. M. . 6.0- 8.0 amperes	1800 R. P. M. . . . . 13.5-15.6 amperes
1000 R. P. M. . 11.7-13.6 amperes	2500 R. P. M. . . . . 11.5-13.5 amperes
1200 R. P. M. . 14.4-16.2 amperes	

GENERATOR: Four pole shunt wound machine with field coil on each pole.

Two main brushes set at 90 degrees from each other on lower side of commutator, positive on right, negative (grounded) on left. Third brush on upper side of commutator.

Test Terminals: Ammeter between generator terminal from which wire runs to cut-out and wire removed. Voltmeter between this terminal and ground.

Motoring current, 3.5 amperes at 6.0 volts.

Field Terminals: Shunt field between third brush and ground.

REGULATION: Third brush controls field current and output. Third brush on upper side of commutator, mounted on a small ring type holder which may be rotated in either direction after loosening the nut on the adjusting stud attached to the third brush holder.

Moving the third brush to the left (counter-clockwise) will increase the charge rate, moving it to the right will lower the rate.

CUT-OUT: Magnetic, mounted on generator.

Closes at 7.0-7.5 volts, 630-650 R. P. M.

Opens with discharge of 0.0-2.0 amperes.

Increasing the spring tension by bending the arm or closing some of the coils raises the voltage and speed of closing.
Lessening the spring tension lowers the discharge for opening.

STARTER: Six pole machine with series field coil on each pole. The inner end of each coil is grounded and the other end is attached to a negative coil connecting ring to which are also attached the two negative brushes.

Four main brushes, one positive and one negative set 60 degrees from each other on one side of commutator, other positive and other negative also 60 degrees from each other and opposite the first two. Two positive brushes are connected together and to the motor terminal by a cable lead.

Running free	50-60 amperes	6.0 volts	
1400 R. P. M.	150 amperes	5.2 volts	1.65 Ft.-Lbs.
Locked.		4.3 volts	10.00 Ft.-Lbs.

DIAGRAM: See Diagram 2254.

SPLITDORF

APLCO MOTOR-GENERATOR, 6-30 Volt System.

MODEL: A-7.

VOLTAGE: 6 for charging and lighting, 30 for starting.

CHARGE RATE: With the battery discharged to a point such that the voltage while being charged is below 2.5 volts per cell, or 7.5 volts for the parallel connection of three cells in each group; the rate will reach a maximum of 22 amperes at high speeds.

With the battery charged to such a point that the cell voltage is above 2.5 per cell, the stop-charge relay opens and inserts field resistance to allow a maximum rate of 5 to 6 amperes.

MOTOR-GENERATOR: Four-pole machine with four field coils having shunt and series windings in each coil. Four brushes, two opposite positives connected together and two remaining negatives connected together.

Single armature and commutator, with single armature winding, for both starting and charging.

Test Terminals: Ammeter between either outside terminal on the motor-generator and the wire removed. Engine to be cranked by hand as this connection carries the starting current. Voltmeter between the two outside terminals on the motor-generator.

Field Terminals: Series field windings between negative brushes and the left hand outside terminal on the motor-generator (from commutator end). Shunt field winding between the negative brushes and the center terminal on the motor-generator.

REGULATION: With the battery charged so that the cell voltage is less than 2.5, the machine acts as a reversed series dynamo. When the battery voltage reaches 2.5 per cell, or more, the contacts of the "stop-charge" relay (lower relay in controller unit) are caused to separate by the magnet, one of whose windings is connected across the positive and negative sides of the battery so that the magnetism is affected by battery voltage. With these contacts opened, the shunt field current is forced through a resistance winding which is also wound on the magnet core, and the charge rate is reduced until the battery voltage falls to a point that allows the contacts to again close and short circuit the field resistance winding.

The stop-charge relay is adjusted by changing the tension of its armature spring, this tension being controlled with a screw. The adjustment is made with a voltmeter connected between the (negative) binding terminal post between the upper and lower relays and the (positive) connecting screw between the two fuses carried in the controller. The spring tension is to be adjusted so that the contacts separate when the meter shows 8.0 volts.

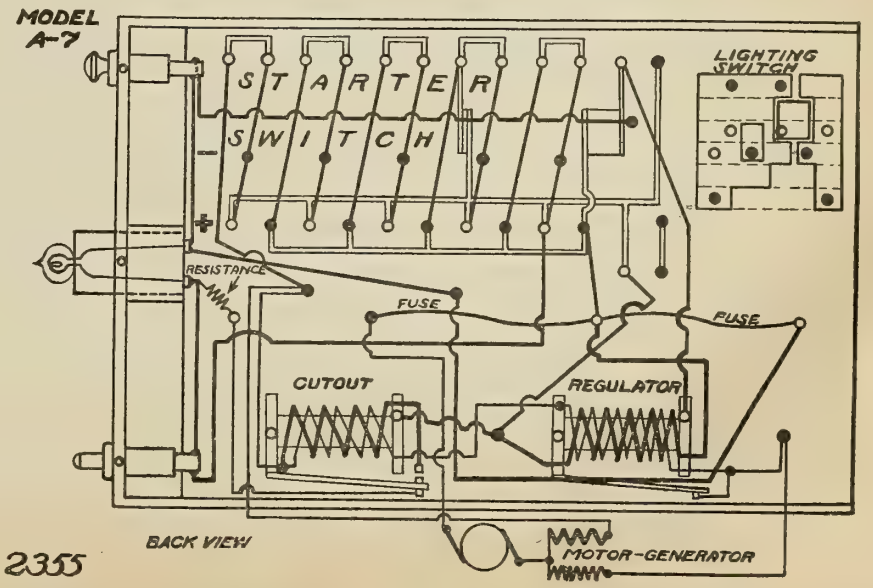
CUT-OUT: Magnetic, carried in the upper part of the controller and switch unit.

On top of the controller is a pilot lamp and this lamp should glow red when the cut-out is open. When the cut-out closes, this lamp goes out. It is controlled by an auxiliary set of contacts on the cut-out armature.

There are three adjusting screws on the cut-out. One screw adjusts the gap between the main contact points. A second screw is for adjusting the gap between the armature and the magnet core, this adjustment also affecting the contact points. Ordinary adjustments are made with the third screw, which alters the tension of the cut-out spring; increasing this tension raises the speed and voltage of closing, lessening the tension lowers the discharge for opening.

STARTER: The machine acts as a 30-volt compound wound starting motor while cranking. With the controller turned to the starting position the fifteen cells of the battery are connected in straight series circuit, giving 30 volts. In the running position of the commutating switch, the battery is arranged in five sets of three cells each with the sets connected in parallel to give six volts for lighting and for charging.

DIAGRAM: See Diagram 2355, below.



SPLITDORF

SEPARATE GENERATORS, CONSTANT CURRENT SYSTEM

MODELS: GU and RGU.

VOLTAGE: 6.

CHARGE RATE: On machines equipped with Splitdorf VR regulator—
Battery charged, generator warm, the setting should be made at 7.0-10.0 amperes, 7.5-7.75 volts, 1200-1400 R. P. M. These limits should be maintained at all higher speeds.

On machines equipped with Ward Leonard CC regulator—
Battery charged, generator warm, the setting should be made at 10.0 amperes, 6.5-7.5 volts, 1200 R. P. M. This rate should not be exceeded at higher speeds.

With discharged battery the maximum output of these generators is from 12-14 amperes.

GENERATOR: Both models are four pole machines, shunt wound. They have either two or four field coils and either two or four brushes.

Test Terminals: On machines with separate regulator—ammeter between generator terminal A and wire removed; voltmeter between this terminal and ground. On machines with regulator mounted on generator—ammeter between terminal on regulator and wire removed (on Splitdorf VA regulators, ammeter can be inserted in line from terminal A to generator; on Ward Leonard regulators ammeter can be inserted in line from terminal B to generator), voltmeter between above mentioned terminals and ground.

Field Terminals: On machines with separate regulator the shunt field is between generator terminal F and ground. On machines with Splitdorf VA regulator the shunt field is between regulator terminal F (red wire) and ground. On machines with Ward Leonard regulator the shunt field is between regulator terminal C (red wire) and ground.

Open link field fuse between Splitdorf regulator terminal F and the regulator contact bracket.

REGULATION: Ward Leonard Type CC regulator—
Regulator contacts are below and at the right with the field resistance unit mounted next the magnet coil and connected between them. Contacts and resistance are in series with the shunt field circuit between regulator terminals B and C. The charge rate is increased by increasing the tension of the outside spring, the tension being changed by bending the bracket holding the upper end of the spring. Lessening the spring tension lowers the charge rate.

Splitdorf VR regulator—
Regulator contacts and armature on terminal side of unit with field resistance mounted above the terminals and connected between the contacts. Contacts and resistance are in series with the shunt field circuit between regulator terminals F and A. The charge rate is increased by increasing the regulator spring tension by means of the screw near the right hand end of the spring when facing the terminal side. The contact carried by the stationary bracket is mounted on the end of a screw held by a lock nut near the left hand end of the unit.

CUT-OUT: Magnetic, combined in single unit with regulator and carried on the generator or on the dash.

Closes at 6.5-7.5 volts, 650-750 R. P. M. Opens with discharge of 0.0-3.0 amperes.

On Ward Leonard controller the cut-out contacts are at the top on the right hand side. The inside spring is for the cut-out and its tension is increased by bending the bracket holding the lower end of the spring. The armature and contact gap is changed by bending the stop below the movable cut-out contact.

On Splitdorf controller the cut-out contacts and armature are on the side opposite the terminals. The cut-out spring tension is changed by turning the screw at the pivoted end (right hand when facing terminals) of the armature.

DIAGRAMS: See Diagrams 2360, 2361 and 2362.

SPLITDORF

MOTOR-GENERATOR, REVERSED SERIES CONTROL

MODELS: A-25, A-27, A-28, A-29.

VOLTAGE: 12 volt starting, 6 or 12 volt charging, 6 or 12 volt lighting.

CHARGE RATE: With charged battery and warm generator, at 1500-2000 R. P. M. 6 volt charging (6-12 volt system) 13-15 amperes.

12 volt charging (12-12 volt system) 7-8 amperes.

MOTOR-GENERATOR: Four pole machine with two field coils, one above armature and the other below. Shunt, reversed series and starting series windings in each coil.

Four brushes, top and bottom positive and joined together. Right and left hand negative and joined together. Single armature and one commutator for both charging and starting.

Test Terminals: Ammeter between +D (lower right hand) terminal on motor-generator and wire removed. Voltmeter between +M and −D terminals on motor-generator (upper and lower terminals on left hand side).

Field Terminals: Shunt field windings between motor-generator terminals +D and −D. Reversed series field windings between motor-generator terminals +D and +M. Starter series field windings between motor-generator terminals +M and −D with armature and brushes in this circuit.

REGULATION: Reversed series field windings oppose shunt fields when generating to limit output. No adjustment provided.

CUT-OUT: Magnetic, mounted as separate unit.

Closes at 750-800 R. P. M.; 6.5-7.0 volts on 6 volt charging systems; 13.0-14.0 volts on 12 volt charging systems. Opens with discharge of 0.0-3.0 amperes on 6 volt system and 0.0-2.0 amperes on 12 volt system.

There are three windings on the magnet. The main series coil is between terminal +D and the metal of the unit. The shunt winding is between terminal −D−B and the stationary auxiliary contact of the pair that are opened when the main contacts close. A resistance coil is in parallel with the shunt between the same points. After the main contacts close, the shunt circuit is opened by these auxiliary contacts.

STARTER: The starting switch used with the 6-12 volt systems has two sets of contacts. Four heavy contacts are joined two and two with the contactor pressed down. This connects the two halves of the battery in series for starting and at the same time the upper leaf spring contacts open the 6 volt charging circuit.

DIAGRAM: See Diagram 2363.

U. S. L.

EXTERNAL REGULATOR SYSTEMS

TYPES: Internal Armature, 6-12 Volt.

External Armature, 12-24 Volt.

VOLTAGE: Internal Armature Type, 6 volt charging and lighting, 12 volt starting.

External Armature Type, 6 or 12 volt lighting, 12 volt charging, 24 volt starting.

CHARGE RATES: Internal armature type, 6 volt charging; the maximum output at high speed, with generator and regulator warm, should be 18 amperes.

External armature type, 12 volt charging; the maximum output at high speed should be 8-10 amperes.

MOTOR-GENERATOR: Internal Armature Type—
Eight pole machine with generator shunt windings on four alternate poles and series starter windings on four intermediate poles. Four brushes, two positive and two negative, on upper side of commutator set at 45 degrees from each other.

External Armature Type—
In this type of machine, the armature is in the form of a ring and rotates outside of the pole pieces. Eight pole unit with generating shunt windings and starter series windings on each of the eight poles. Eight brushes equally spaced around commutator. Four alternate positive brushes joined together through ring; four intermediate negative brushes joined together through second ring.

Test Terminals: Ammeter betwen A + terminal on motor-generator and wire removed (this connection carries starting current and engine should be cranked by hand). Ammeter may also be connected between A + controller terminal and wire removed, this connection carrying no starting current. Voltmeter between A + and A − terminals on motor-generator or between A + and A − terminals on starting switch.

Field Terminals: Shunt field windings between negative brushes and terminal F + on motor-generator. Series field windings between negative brushes and terminal A − on motor-generator.

Brush pressure on Type E-12 to be 1.75 pounds per brush; on all other types to be 1.25 pounds per brush.

The angular brushes on Type E-49 should bear squarely against the side of the brush pocket away from which the commutator rotates. The radial brushes on all other types should bear squarely against the side of the holder toward which the commutator rotates.

REGULATOR: Constant current maintained above rated speed by magnetic regulator controlling pressure on a series of carbon discs carried in the upper part of the controller and connected in series with the shunt field winding. The charging current flows around the magnet and as this current increases, the pull of the magnet releases the pressure on the carbon discs, allowing them to separate slightly and increase their effective resistance, thus lowering the field current and output.

There are two adjustments for this regulator. First adjust the upper plug in the right hand bar so that the air gap at the carbon pile (upper) end is between $\frac{3}{32}$ and $\frac{1}{8}$ inch. Greater gap raises the cutting in speed, smaller gaps make the cut-out lever (on the left side) vibrate at high engine speeds. The charge rate is then adjusted by turning the large lower screw in the right hand bar in, to the right, to increase the output, turning it out to lower the output. The air gap should be set before adjusting the charge rate.

If adjusting the regulator does not give the desired rate and the commutator and brushes are known to be in good order, the carbon discs probably need cleaning. They can be removed by unscrewing the plug at end of upper glass rod and removing the rod. The discs can be rubbed together or against a smooth board until they are smooth and flat. The end brass plates should also be cleaned. When replacing carbons, make sure that they fit true against end plates and that screw heads do not project beyond faces of discs.

These equipments are fitted with a "Touring Switch" with a double set of contacts. One set opens the circuit between battery and regulator, the other between generator and regulator. This switch is opened to stop the charge on long daylight drives and under similar conditions. Otherwise it should remain closed.

U. S. L.

EXTERNAL REGULATOR SYSTEMS—*Continued*

CUT-OUT: Magnetic, combined in same controller unit with regulator.

Closes on 6-12 volt internal armature types at 8-10 miles an hour; on 12-24 volt external armature types at 10-14 miles an hour.

Opens with discharge of 0.0-4.0 amperes.

The cut-out spring is in the lower left corner of the controller and its tension is adjusted by loosening one of the lock nuts at the right hand end of the spring and turning the other nut. After changing the spring tension, the regulator should be adjusted as directed under "Regulation."

STARTER: Rotary drum switch carried under floor boards changes voltage for starting.

The switch may be opened by taking off the top cover and removing two screws in the corners, this allowing the bottom cup to drop off. The cup should be held up while the screws are being removed as it is filled with oil. The body of the switch remains on its supports.

The switch contact fingers and drum segments should be cleaned and the switch cup re-filled with high grade transformer oil to within $1\frac{5}{8}$ inches of the top, then replaced.

DIAGRAM: See Diagram 2551.

U. S. L.

INHERENT REGULATION SYSTEM, 12-24 VOLT

VOLTAGE: Charging at 12 volts, starting at 24 volts, lighting at either 6 or 12 volts.

CHARGE RATE: With warm generator, after 15-20 minutes run under load, the maximum rate should be 11-12 amperes reached at 600-700 R. P. M. of crankshaft.

MOTOR-GENERATOR: Eight pole machine with ring shaped armature rotating outside the pole pieces. Shunt and series field windings.

Eight brushes arranged at even intervals around the commutator, positive and negative alternating. The three lower brushes, one positive and two negative, are the only ones used while the machine acts as a generator.

Brush pressure on the three lower brushes to be 1.75 pounds per brush, on remaining five brushes to be 1.25 pounds per brush. Each brush should bear squarely against the side of its pocket away from which the commutator rotates.

Test Terminals: Ammeter between G + terminal on cut-out or touring switch and wire removed. Voltmeter between G + and G – motor-generator terminals.

Field Terminals: Shunt field windings between A – and F + terminals on motor-generator. Series field windings between A – and G – terminals on motor-generator.

REGULATION: Operates as a reversed series machine while generating. No adjustment provided.

CUT-OUT: Magnetic, mounted as separate unit and carrying 6-ampere field fuse and 30-ampere charging circuit fuse on same base.

Closes at 13.0-14.0 volts, 10-12 miles an hour; opens with discharge of 0.0-2.5 amperes.

There are two pairs of contacts, one pair (carbon) outside and the other pair (copper) inside. The outside carbon contacts should be set to close first and open last so that they will take any spark occurring when the cut-out opens.

The armature gap is adjusted by the nut and stud passing through the armature near the pivoted end. The spring tension is adjusted by bending the leaf spring under the armature with flat nosed pliers.

TOURING SWITCH: A "Touring Switch" carries a double set of contacts; one set opens the circuit between the positive of the battery and the cut-out; the other opening the circuit between generator and cut-out. With the switch open there is no charge. It should only be opened when the battery is fully charged and while the car is being driven without the lamps in use. At all other times it should be closed.

STARTER: Rotary drum switch under floor boards changes voltage for cranking. The switch is opened by removing the top cover and taking out three screws, this allowing the bottom cup to drop off into the hands and leaving the switch body on its mounting.

The contacts and segments should be cleaned and the case refilled with high grade transformer oil to within 2¾ inches of the top.

DIAGRAM: See Diagram 2553.

U. S. L.

INHERENT REGULATION SYSTEM, 12-12 VOLT

VOLTAGE: 12.

CHARGE RATE:

Cuts in	325-350 R. P. M.
10.0-11.0 amperes	400 R. P. M.
12.0-12.5 amperes	550 R. P. M.
12.0 amperes	700 R. P. M.
10.0 amperes	1100 R. P. M.
9.0 amperes	1600 R. P. M.

MOTOR-GENERATOR: Eight pole machine with motor series windings on six poles, shunt winding on one pole, and reversed series and compensating winding on remaining pole.

Eight brushes, three bottom only ones used while generating.

Pressure on three bottom brushes to be 1.75 pounds per brush, on remaining five brushes to be 1.25 pounds per brush. Each brush should bear squarely against that side of its pocket away from which the commutator rotates. In sanding these brushes draw the sandpaper against direction of armature rotation.

Test Terminals: Ammeter between A+ terminal on control box, or +G terminal on separate cut-out, and wire removed. Voltmeter between A+ and B− terminals on motor-generator.

Field Terminals: Series field windings between negative brush ring and B− terminal. Shunt field winding between negative brush ring and F+ terminal. Compensating winding between negative brush at left of bottom generator positive brush and negative brush ring.

Field Fuse: 5-ampere field fuse carried in control box or 6-ampere field fuse carried at right hand upper corner of base for separate cut-out.

REGULATION: Reversed series field winding limits output. Its action is affected by the compensating winding in such a way as to secure a drop in the output above the critical speed. No adjustment provided.

CUT-OUT: Magnetic, carried in control box or as a separate unit.

Closes at 13.0-14.0 volts, 325-350 R. P. M. of crankshaft. Opens with discharge of 0.0-2.5 amperes.

The separate cut-out is the same as that described in the preceding Section 2502.

On the cut-out in the control box, the spring tension is adjusted by bending the flat spring; the gap is adjusted by bending the armature stop.

STARTER: The starting switch closes the circuit from the battery to the positive motor brushes. On the control box equipments this switch is operated by a magnet energized when the start button is pressed.

DIAGRAM: See Diagram 2555.

WAGNER

MOTOR-GENERATOR

TYPE: 7-ES, Specification 101, 102, 103, 104, 105.

VOLTAGE: 12 for charging and starting, 6 for lighting.

CHARGE RATE: With hot generator and charged battery; maximum charge rate of 9-10 amperes.

MOTOR-GENERATOR: Four pole machine with shunt and series field windings. Armature has two windings with commutator on each end. Each commutator carries four brushes, three of them at 90 degree intervals and the fourth offset and connected to the shunt field.

Test Terminals: Ammeter between terminal farthest from cut-out on right hand side of rotary switch (looking at cut-out end) and wire removed. Voltmeter between middle terminal on right hand side of switch (looking at cut-out end) and terminal nearest cut-out on left hand side.

Field Terminals: Series field winding between middle terminal on left hand side of switch (facing cut-out end) and the large lead running to the negative side of the battery. One half of shunt field between terminal on left side of switch and farthest from cut-out and one of the offset brushes. The other half of the shunt field is between the switch terminal nearest the cut-out on the right hand side and the other offset brush.

REGULATION: Shunt field windings connected to the offset (regulating) brushes to limit field current and output.

Adjustment is made by slightly rotating the brush rings. The rings are held in place by pointed set screws, one at the top and the other at the bottom on each end. The brushes should be lifted from the commutator at the end that is not being adjusted and the ring on the end being adjusted is then moved to secure one half the desired output. The other end is then adjusted while the brushes are lifted on the first one, making the second setting so that the output is the same as for the first one adjusted. With both sets of brushes lowered onto their commutators, the total output will be equal to the sum of the two ends.

CUT-OUT: Magnetic, mounted on top of the motor-generator and at one end of the starting switch.

Closes at 14.0-15.0 volts; opens with discharge of 0.0-2.0 amperes.

The contact gap is adjusted by the screw against which the upper end of the armature rests with the contacts open. The spring tension is adjusted by raising or lowering the small horseshoe shaped washer at the bottom of the cut-out spring and underneath the fastening screw.

STARTER: The rotary drum switch opens the shunt field circuit and allows operating as a straight series wound motor while cranking.

DIAGRAM: See Diagram 2751.

WAGNER

FOUR BRUSH GENERATORS, "THIRD BRUSH" REGULATION

TYPES: Spec. EM107, EM111, EM114.

VOLTAGE: 6 volts for 107 and 114, 12 volts for 111.

CHARGE RATES: The charge rate depends on the condition of battery charge and voltage. Settings should be made only with a fully charged battery and by measuring both amperage and voltage, the ammeter at the generator and the voltmeter across the battery terminals.

On 6 volt units the setting should be made at 17-19 amperes with a battery voltage of 7.8 (fully charged). The maximum setting with a battery voltage of 7.5 should be 16.5 amperes. Both of these are peak settings.

On 12 volt units the setting should be made at 8.5-9.0 amperes with a battery voltage of 15.5 (fully charged). The maximum setting with a battery voltage of 15.0 should be 8.0 amperes. These are peak settings.

The maximum rates given above should be attained at 1400-1700 R. P. M.

GENERATOR: Four pole shunt wound machine with four field coils. There are two main brushes set at 90 degrees from each other. The remaining brushes are field brushes, one on one side and above the center, this offset brush being used for adjustment.

Test Terminals: Ammeter between either lead from the generator and its connection to outside lines or the cut-out. Voltmeter between the two generator leads.

Field Terminals: Shunt field windings in series between the field brush and the offset brush on one side. On Spec. 114 a field fuse is in this circuit and mounted on the outside of the generator.

REGULATION: Regulating brush controls field current and output. Moving this brush down (with direction of armature rotation) increases the charge rate; moving it up against rotation lowers the rate.

The brush holder is held in place by a screw passing through a slot in the commutator end plate. With this screw loosened the brush can be moved either way.

CUT-OUT: Magnetic, mounted on the generator or as a separate unit. Closes at 500-600 R.P.M.; 6.5-7.0 volts on 6 volt systems, 13.0-14.0 volts on 12 volt systems. Opens with discharge of 0.0-2.5 amperes.

The spring tension on the 6 volt cut-out is increased by bending outward on the brass support that holds the end of the spring, bending inward lessens the spring tension and lowers the cut in voltage.

The spring tension on the 12 volt cut-out is changed by first loosening the lock nut on the screw that passes through the outer end of the spring. The screw is then turned in to increase the spring tension and raise the voltage of cut in, or turned outward to lessen the tension and lower the cut in voltage.

DIAGRAMS: See Diagrams 2753, 2754 and 2755.

WAGNER

SIX VOLT GENERATORS

TYPES: Spec. EM—114, 126, 153, 155, 157, 162, 165, 167, 169, 174, 189, 189A.

200, 202, 214, 276, 277, 278.

303, 305, 316, 326, 337, 338, 339, 341, 346, 352, 355, 357, 370, 385.

VOLTAGE: 6.

CHARGE RATE: Setting to be made with hot generator and fully charged battery. Ammeter to be connected at generator and voltmeter across battery terminals.

Set at 15.0-16.0 amperes, 8.6 volts (battery), 1400-1600 R. P. M.

Approximate limits of performance:

6.0 amperes	725- 850 R. P. M.
9.0 amperes	850- 975 R. P. M.
12.0 amperes	1000-1125 R. P. M.
16.0 amperes	1400-1700 R. P. M.
12.0 amperes	2050-2400 R. P. M.
9.0 amperes	2600-3000 R. P. M.

GENERATOR: Two pole shunt wound machine with two field coils, except Spec. 278 which has four poles and four coils.

Two main brushes set opposite each other with third brush above or below center on right hand or left hand side on all except Spec. 278 which has two main brushes set at 90 degrees from each other with third brush on opposite side of commutator.

Test Terminals: Ammeter between generator terminal and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field coils in series between third brush and generator terminal.

REGULATION: Third brush controls field current and output. Moving this brush in the direction of armature rotation increases the output; moving it against rotation lowers the rate.

The third brush may be moved either way after loosening the locking screw. This screw may appear through the commutator end plate of the machine and work in a curved slot; or it may be inside of the end plate and reached through the brush windows. The screw is sealed in place.

CUT-OUT: Magnetic, mounted as separate unit.

Closes at 6.5-7.5 volts, 500-650 R. P. M.; opens with discharge of 0.0-2.0 amperes.

On the type shown in drawing 2763, the armature and contact gap is adjusted by bending the stop arm above the armature; increasing the gap to raise the cut in voltage and speed, lessening the gap to lower the voltage and speed.

On the type shown in drawing 2764 the spring tension is changed by bending the support for the pivoted end of the spring and armature; bending it down to increase the cut in speed and voltage, up to lower the speed and voltage.

On the type shown in drawing 2765 the armature and contact gap is adjusted by bending the small brass stop against which the armature rests with the contacts open. Bending this stop up increases the cut in speed and voltage, bending it down lowers the speed and voltage.

DIAGRAMS: See Diagrams 2757 to 2765 inclusive.

WARD LEONARD

GENERATOR WITH TYPE E CONTROLLER

MODELS: AXL, CW, F.

VOLTAGE: 6.

CHARGE RATE:

500-550 R. P. M.	Cuts in
600 R. P. M.	2.5 amperes
700 R. P. M.	5.0 amperes
800 R. P. M.	8.7 amperes
900 and above	10.0 amperes, maximum

GENERATOR: Two pole, shunt wound machine with two field coils, one above and one below armature.

Two brushes set on opposite sides of commutator.

Test Terminals: Ammeter between generator terminal A (from which line runs to battery and terminal A on regulator) and wire removed. Voltmeter between generator terminals A and B or between regulator terminals A and B.

Motoring Current: 2.5-3.0 amperes at 350-400 R. P. M.

Field Terminals: Shunt field between generator terminals A and C.

REGULATION: Constant current maintained above rated speed by vibrating regulator, Type E, controlling shunt field resistance.

The regulator magnet and coil are on the right hand side of the unit with the winding connected between terminal D and the stationary cut-out contact (circuit also includes series winding of cut-out at left). The regulator contacts are those toward the bottom and at the right. Between the contacts is connected the resistance unit mounted between the two magnets.

The charge rate is raised by increasing the spring tension, lowered by decreasing the tension. The spring tension is altered by bending the support at the end opposite the regulator contacts.

CUT-OUT: Magnetic, carried in same unit with regulator. The cut-out magnet and winding are at the left. The series winding is in series with the regulator winding between terminal D and the stationary contact. The shunt winding is between terminals A and B.

Closes at 7.0-7.5 volts, 500-550 R. P. M.; opens with discharge of 0.5-2.0 amperes.

Air gap adjusted by bending the stop for the movable contact arm. Spring tension changed by bending the spring support at the end opposite the contacts.

STARTER: See Wagner-Hoyt Starting Motors, Section 2811.

DIAGRAM: See Diagram 2851.

NOTE: For Ward Leonard Controller, Type CC, see Splitdorf Systems. See diagram 2362.

For Ward Leonard Controller, Type CD, see Detroit Ward Leonard Systems and Disco Systems. See diagrams 2853 and 2854.

WARD LEONARD

WAGNER-HOYT GENERATORS AND MOTORS

TYPES: Generators; K, KD, RW, RE-125.
Motors; W-12, W-25, W-27, W-32.

VOLTAGE: 6.

CHARGE RATES:

	Type K	Type KD	Type RW	Type RE-125
Cuts in	600 R. P. M.	1300 R. P. M.	550 R. P. M.	350 R. P. M.
2.0 amperes	660 R. P. M.	1425 R. P. M.	640 R. P. M.	430 R. P. M.
4.0 amperes	720 R. P. M.	1550 R. P. M.	730 R. P. M.	510 R. P. M.
6.0 amperes	780 R. P. M.	1675 R. P. M.	820 R. P. M.	590 R. P. M.
8.0 amperes	840 R. P. M.	1800 R. P. M.	910 R. P. M.	670 R. P. M.
10.0 amperes	900 R. P. M.	.....	1000 R. P. M.	750 R. P. M.

Charge rates remain constant above highest speed shown.

GENERATOR: Four pole shunt wound machines with four field coils.
Type RE-125 runs at engine speed.
Type K runs at 1½ times engine speed.
Type RW runs at twice engine speed.
Type KD runs at three times engine speed.
Two brushes set at 90 degrees from each other.

Test Terminals: Ammeter between controller terminal A and wire removed. Voltmeter between controller terminals A and B.

Field Terminals: Shunt field between generator terminals connected to controller terminals A and C.

REGULATION: Ward Leonard controller; see preceding Section 2801.

CUT-OUT: In Ward Leonard Controller; see preceding Section 2801.

STARTER:

Speed, R. P. M.	W-12		W-25		W-27		W-32	
	Ft.-Lbs.	Amps.	Ft.-Lbs.	Amps.	Ft.-Lbs.	Amps.	Ft.-Lbs.	Amps.
Locked	12.0	500	21.0	515	27.0	525	35.0	725
500	7.0	315	7.5	250	10.0	235	16.5	425
1000	4.0	225	3.0	150	4.5	150	6.5	225
2000	1.5	130	1.3	90	1.5	75	1.3	85

DIAGRAM: See Diagram 2876.

WESTINGHOUSE

SINGLE FIELD COIL GENERATORS AND IGNITION-GENERATORS, ONE WIRE TYPES

FRAMES: 200, 201, 202, 203, 206, 207, 208, 210, 211, 215, 220, 221, 230, 231, 232, 233, 234, 235, 236, 240, 241, 242, 243, 244, 245, 246, 250, 251, 252, 254, 255, 256, 258, 260, 261, 275, 280, 281, 282, 283, 284, 285.

VOLTAGE: 6 volts for all except those noted in table of Charge Rates.

CHARGE RATES: Measured with all lamps off and charged battery, generator cold. Lower rates with hot generator.

Frame Number	Cut In R. P. M.	Amperes at R. P. M. of				Voltage	Notes
		700	1000	1500	2000		
200	425	5.5	8.5	10.5	11.5	6	
201	550	4.0	8.0	10.5	11.5	6	
202	400	5.8	8.5	10.4	11.3	6	1 wire
202	400	8.0	11.0	13.0	15.0	6	2 wire
203	400	5.8	8.5	10.4	11.3	6	
205, 6	400	5.5	7.0	8.0	8.5	12	
208	450	5.4	8.0	10.4	12.0	6	6 volt
208	425	5.0	7.0	8.5	9.0	12	12 volt
210	425	5.5	8.5	10.5	11.5	6	
207, 11	400	5.8	8.5	10.4	11.3	6	
215	450	5.7	8.8	10.6	11.5	6	
220	550	4.0	8.0	10.5	11.5	6	
221	400	5.8	8.5	10.4	11.3	6	
230-233	400	8.2	11.2	14.5	16.0	6	
234	425	4.5	6.0	7.0	7.4	12	
235	425	4.5	6.0	7.0	7.4	12	
236	400	8.4	11.6	13.6	14.2	6	
240-243	400	7.7	10.0	11.6	12.9	6	
244	400	4.5	6.0	7.0	7.4	12	
245	425	4.5	6.0	7.0	7.4	12	
246	425	6.0	8.0	9.2	10.0	6	
250	450	8.5	10.5	11.5	12.0	6	
251	400	5.5	7.2	9.0	9.6	6	
252	325	5.5	7.2	9.0	9.6	6	
254	325	3.5	5.2	8.0	8.6	12	
255	350	3.5	5.2	8.0	8.6	12	
256	380	9.0	10.8	13.0	15.0	6	
258	300	6.0	9.5	10.2	10.6	12	
260	400	8.5	10.5	11.5	12.0	6	
261	350	5.5	7.2	9.0	9.6	6	
275	450	5.7	8.8	10.6	11.5	6	
280-283	400	10.0	13.0	15.5	16.5	6	
284	400	5.5	7.0	8.0	8.5	12	
285	400	5.5	7.0	8.0	8.5	12	

GENERATOR: Some of these generators, such as 230, 236, 240, 246, 280, etc., have an ignition coil mounted in the housing with an ignition breaker and distributor built on and driven direct from the armature shaft. Others are plain lighting generators. The generator construction and action is the same regardless of the arrangements for ignition.

Two pole machines with single wound pole above the armature. This pole carries the generator shunt field winding below and the reversed series winding above.

Two brushes on opposite sides of commutator, positive on right, negative on left.

Test Terminals: Ammeter between terminal B and wire removed. This is the left hand terminal looking at the drive end. Voltmeter between terminal L (right hand from drive end) and ground.

Field Terminals: Reversed series field winding between terminals L and B. Shunt field between terminal B and positive (right hand) brush. The shunt and series winding of the cut-out will be in series with the shunt field winding between these points. The shunt field terminals can be reached by removing the drive end head of the machine.

Frames	Motoring Amperes	Field Amperes	Frames	Motoring Amperes	Field Amperes
202, 3, 7	3.5	1.0-2.0	244, 245	1.0-2.5	1.0-1.5
208	2.5-3.5	1.5-2.5	246	2.5-3.5	1.5-2.5
211	3.5	1.0-2.0	251, 52, 54, 55	3.5	1.0-2.0
215	2.5-3.5	1.5-2.5	256	2.5-3.5	1.5-2.5
211, 21, 30, 31, 32, 33	3.5	1.0-2.0	261	3.5	1.0-2.0
234, 35	1.0-2.5	1.0-1.5	275	1.0-2.5	1.0-1.5
236	2.5-3.5	1.5-2.5	280, 81, 82, 83	3.5	1.0-2.0
240, 41, 42, 43	3.5	1.0-2.0	284	1.0-2.5	1.0-1.5

REGULATION: With no lamps turned on these machines are of the reversed series type with all of the charging current passing through the reversed series field.

The lamp lines are connected to terminal L and current for the lamps returns directly through L and the negative brush, without going through the reversed series winding; thus the lamp current is subtracted from the reversed series field flow and the output is increased in proportion to the number and candlepower of lamps lighted.

WESTINGHOUSE

SINGLE FIELD COIL GENERATORS AND IGNITION-GENERATORS—*Continued*

CUT-OUT: Magnetic, mounted in drive end of generator above drive shaft.

Closes at 7.0-7.5 volts with current of 1.0-1.5 amperes, at speeds given in table of Charge Rates.

Opens with discharge of 0.75-1.25 amperes.

Gap adjusted by bending the stop at right hand end of armature.

Spring tension adjusted by bending spring support.

STARTER: See Section 2941 on Westinghouse Starting Motors.

DIAGRAMS: See Diagrams 2951, 2953, 2957, 2958 and 2959.

WESTINGHOUSE

FOUR POLE REVERSED SERIES (INHERENT) REGULATION GENERATORS

FRAMES: 520 and 521.

VOLTAGE: 6.

CHARGE RATES: With a hot generator the charge rates will be from 25 to 35 per cent lower than given.

Frame Number	Cut In R. P. M.	600	Amperes at R. P. M. of			
			800	1000	1200	1500
520	325	11.0	13.0	14.2	15.0	15.6
521	400	10.0	12.5	14.0	15.0	15.5

GENERATOR: Four pole machine with one field coil above the armature and another below, operating with two wound poles and two consequent poles. Each coil contains the generator shunt winding and the reversed series winding.

Four brushes; upper left and lower right are positive and joined together; lower left and upper right are negative and joined together.

Test Terminals: Ammeter between terminal B and wire removed. Voltmeter between terminal L and ground.

Motoring Current: 6.0 amperes maximum at 6.0-6.3 volts.

Field Terminals: Reversed series field between terminal B and negative brushes. Shunt field between terminal L and stationary cut-out contact (the cut-out shunt winding is in the circuit between these points).

Field Current: 2.5-3.0 amperes at 6.0-6.3 volts.

In addition to terminals B and L, there is an additional terminal marked S (or Switch) between the first two. This terminal connects directly to the positive brushes between the brush lead and the series winding of the cut-out. It is used for the starting switch action.

REGULATION: Same as preceding Section 2902.

CUT-OUT: Magnetic, mounted on generator at end opposite the drive and brushes.

On 520 cut-out closes at 325 R.P.M., 6.0-6.75 volts; opens with discharge of 0.0-2.0 amperes.

On 521 cut-out closes at 400 R.P.M., 6.0-6.5 volts; opens with discharge of 0.0-2.0 amperes.

Gap adjusted by bending stop at right hand end of armature. Spring tension adjusted by bending spring support.

See Section 2941 on Westinghouse Starting Motors.

STARTER: With the three terminal generator used in connection with the electromagnetic starting pinion shift and starter switch the action is as follows:

A start button switch is provided with one end grounded and circuit leading through the magnetic starting switch magnet and to the S terminal on the generator. With the generator at rest in starting, the cut-out is open and the S terminal is connected to the positive brushes of the generator. The circuit then goes through the armature and negative brushes and to the B terminal on the generator, then to the battery and ground; thus completing the magnet circuit with the start button pressed. The magnet closes the main starting contacts and shifts the gears, after which the engine is started. With the engine running, the cut-out closes so that the side of the start button circuit formerly called negative becomes positive and with both ends of the magnet circuit now on the same side (positive) it is impossible to again mesh the gears while the cut-out remains closed.

DIAGRAMS: See Diagrams 2961, 2962 and 2964.

WESTINGHOUSE

CONSTANT VOLTAGE GENERATOR, BUILT-IN VIBRATING REGULATOR

FRAMES: 208R, 209R, 236R, 246R, 251R.

VOLTAGE: 6.

CHARGE RATE: Due to constant voltage regulation, the amperage depends on the state of charge of the battery; a discharged battery (1.150-1.200 S.G.) giving high rates, while a charged battery (1.250-1.300 S.G.) gives low rates.

R. P. M.	Amperes with Battery		R.P.M.	Amperes with Battery	
	Charged	Discharged		Charged	Discharged
320		Cuts in	1200	5.7	15.9
360	Cuts in		1400	5.8	16.0
400	0.8	2.2	1600	5.7	16.0
600	5.2	7.5	1800	5.7	16.0
800	5.4	12.2	2000	5.6	16.1
1000	5.6	15.5			

Settings are made as follows:

Frame	R. P. M.	Volts	Amperes
208R	1200	6.8	15.0
208R (Chalmers)	1800	6.8	15.0
209R	2000	6.8	15.0
236R	1200	6.8	15.0
246R	1200	6.8	15.0
251R	1000	6.8	12.0

GENERATOR: Two pole machine with single shunt field winding above armature.

Two brushes at opposite sides of commutator; left hand brush positive and right hand negative (looking at commutator end).

Test Terminals: Ammeter between terminal B and wire removed. Voltmeter between this terminal and ground.

Motoring Current:

208R, 236R and 246R take ..... 2.4-3.0 amperes
208R (Chalmers) takes ..... 3.0 amperes
209R takes ..... 2.3-3.5 amperes
251R takes ..... 2.0-3.0 amperes

Field Terminals: Shunt field between terminal B and the upper contact of the regulator.

Field Current: Shunt field takes 1.5-2.0 amperes at 6.0-6.3 volts, except on 251R, which takes 1.2-1.5 amperes.

REGULATION: Vibrating regulator operated by generator voltage and inserting shunt field resistance above speed and voltage for which set.

Regulator consists of an E-shaped magnet with two pivoted armatures, right hand for the cut-out and left hand for the regulator. Both armatures are pivoted over the center core, with pivoted end of regulator armature above pivoted end of cut-out and magnetically interlocked so that the regulator armature does not operate until after the cut-out closes.

Regulator is adjusted by the thumb screw resting against the extended end of the regulator spring, the screw having a right-handed thread. Increasing spring tension by turning screw clockwise raises the voltage, while turning the screw up lowers the voltage at which the regulator acts.

The magnet to armature gap for the regulator should be .045 to .055 in. with contacts closed. The center gap should be .015 to .019 in.

CUT-OUT: Magnetic built-in unit with regulator as described under **Regulator.** The cut-out contacts are at the right, the complete unit being carried on the driven end of the generator.

Closes at 470 R.P.M., 6.5-7.0 volts on 208R, 236R and 246R.

Closes at 600 R.P.M., 6.5-7.0 volts on 208R (Chalmers).

Closes at 1,000 R.P.M., 6.5-7.0 volts on 209R.

Opens with discharge of 0.5-2.0 amperes.

Gap between end of magnet and armature with contacts closed, to be .055 to .060 in.

Adjustment made by bending the two extending prongs of the brass support located at the end of the cut-out armature. The position of the inner prong determines the spring tension, the position of the outer prong determines the armature gap.

STARTER: See Section 2941 on Westinghouse Starting Motors.

UPKEEP: If there is excessive sparking at the regulator contacts and the regulator does not operate until above the regulating limit, it indicates that the resistance across these contacts is open.

If the regulator allows the voltage to rise excessively with no load at 1200 R.P.M. and there is no sparking, it indicates that the resistance across the contacts is short circuited.

If the difference between the voltage at 1200 R.P.M., no load; and 1200 R.P.M. with 15 amperes resistance load, is much less than 7.0 volts to 6.6 volts, the air gaps are incorrect or clogged.

DIAGRAMS: See Diagrams 2965, 2966 and 2968.

WESTINGHOUSE

CONSTANT VOLTAGE GENERATORS, SEPARATE REGULATOR

FRAMES: 400, 450, 781R, 782R.

VOLTAGE: 6.

CHARGE RATES: Performance with charged battery or discharged battery is the same as given in preceding section.

Settings are made as follows:

Frame	R. P. M.	Volts	Amperes
400	1400	6.8	15.0
450	1200	6.8	15.0
781R	1200	6.5	20.0
782R	1200	6.5	20.0

GENERATOR: Four pole, shunt wound machines, with four field coils.

On Frames 400 and 450—two brushes set at 90 degrees from each other; positive brush (grounded) at right, negative brush (connected to terminal A) at left.

On Frames 251R, 781R and 782R—four brushes, two opposite positives grounded; two opposite negatives joined together and attached to terminal A on front bracket.

Test Terminals: On Frames 400 and 450; ammeter between terminal A (left hand) and wire removed, voltmeter between this terminal and ground. On Frames 251R, 781R and 782R; ammeter between terminal (A) on front bracket and wire removed, voltmeter between this terminal and ground.

Motoring Current:

Frame	Amperes	Volts
400	3.5-4.5	6.0-6.5
450	4.0-5.5	6.0-6.5
781R, 782R	5.0	6.0-6.5

Field Terminals: On Frames 400 and 450, shunt field between terminal F (right hand) and ground. On Frames 251R, 781R and 782R, shunt field between terminal F on outside of housing and the grounded positive brush.

Field Current:

Frame	Amperes	Volts
400	2.5-3.0	6.0-6.3
450	2.7-3.5	6.0-6.3
781R, 782R	1.2-1.8	6.0-6.3

REGULATION: Constant voltage maintained by vibrating regulator controlling shunt field resistance. Construction and adjustment of regulator same as that for preceding section. Regulator-cutout unit mounted separately. Three terminals on bottom, marked A, F, B, from left to right.

Terminal A is connected to generator terminal A, terminal F with generator terminal F, terminal B with negative of battery.

Regulator contacts between terminals A and F.

It is essential that terminals A and F on the generator be connected respectively to terminals A and F on the regulator, for if they are reversed the generator voltage will be thrown directly across the regulator resistance.

If the regulator contacts spark excessively, or if the contacts only operate at speeds higher than the rated speed, it indicates that the field resistance between the contacts is open circuited or that the A and F leads are reversed.

See also **"Upkeep"** under preceding section.

CUT-OUT: Same as for preceding Section 2905, except mounted with regulator as a separate unit.

STARTER: See Section 2941 on Westinghouse Starting Motors.

DIAGRAMS: See Diagrams 2969, 2971, 2972 and 2973.

WESTINGHOUSE

THIRD BRUSH GENERATORS

FRAMES: 150, 151, 400, 450, 760, 765, 35AT, 35BT, 56BT.

VOLTAGE: 6 or 12 on Fame 765, 6 on all others.

CHARGE RATES: Hot generator will give from 2.5 to 3.0 amperes less than when cold. Discharged battery will give lower rate. Truck setting, 4 amperes lower maximum.

Frame Number	Cut-in R. P. M.	Settings			Style Number
		R. P. M.	Volts	Amperes	
35AT	500	1100-1600	8.0	15.0-16.0	
35BT	500	1000-1350	7.5	11.5-12.5	
56BT	400	800-1200	7.5	10.0-12.0	
150	600	1400-1600	7.5	12.0-14.0	Standard
150	600	1450-1750	7.5	15.0-16.0	291582
151	600	1400-1600	7.5	11.0-12.0	
400	500	1100-1400	6.7-7.0	14.0-16.0	
450	400	1100-1300	6.7-7.0	14.0-15.0	
760	500	1100-1500	7.5	15.0-17.0	Standard
760	500	1100-1500	7.5	13.0-15.0	263382
760	450	1100-1500	7.5	11.0-13.0	Truck
760	500	1100-1500	7.5	8.0-10.0	280159
765 6-v	400	900-1400	7.5	15.0-17.0	
765 12-v	450	1000-1400	15.8-16.2	10.5-11.0	Standard
765 12-v	450	750- 950	13.0	9.0-10.0	287942

GENERATOR: Four pole shunt wound machine with four field coils. Two main brushes set at 90 degrees from each other. Bottom brush is negative. Positive brush on either right hand or left hand side. Third brush opposite positive.

Test Terminals: Ammeter between terminal on side of housing and wire removed (the terminal on the end bracket, when used, is for the starter action and leads to the cut-out and negative brush). Voltmeter between terminal on housing and ground.

Motoring Current: At 6.0-6.3 volts.

Frames 35AT, 35BT, 56BT take ..... 5.0 amperes
Frames 150 (283128), 151, 400, 450 take ..... 3-4 amperes
Frames 150 (291582) take ..... 4.2 amperes
Frames 760 take ..... 3.5-5.0 amperes
Frames 765 (6-volt) take ..... 6.0 amperes

Field Terminals: Shunt field winding between field fuse and negative (lower) brush on machines having a second terminal on the end bracket. On other machines the shunt field is between the field fuse and the main terminal on the housing.

Field Current: At 6.0-6.3 volts.

Frames 35AT, 35BT take ..... 2.5-3.0 amperes
Frames 56BT, 765 (6-volt) take ..... 3.2-3.7 amperes
Frames 150 (283128), 151 take ..... 2.2-2.7 amperes
Frames 150 (291582) take ..... 3.2-4.0 amperes
Frames 400 take ..... 2.7-3.2 amperes
Frames 450 take ..... 3.0-4.0 amperes
Frames 760 take ..... 2.5-3.5 amperes
Frames 765 (12-volt, high field resistance) take ..... 1.7-2.2 amperes
Frames 765 (12-volt, 287942) take ..... 4.5-5.2 amperes

Field fuse between third brush and end of shunt field winding. Fuse is 5-ampere, placed either in cut-out or outside the commutator end bracket of generator.

REGULATION: Third brush controls field current and output. Third brush is at right hand or left hand side of the commutator, nearly opposite the positive main brush. Moving this brush with the direction of armature rotation increases the charge rate, moving it in the opposite direction lowers the charge rate.

To adjust the third brush on older types of generators (400, 450, etc.), remove the wax from the four screws at the corners of the brush holder bracket, loosen the screws and move the brush. After the setting has been made, tighten and seal the screws.

On the newer types third brush holder is fastened by an insulating ring and a single hexagon nut. After loosening this nut the holder and brush can be moved in either direction.

CUT-OUT: Electromagnetic, mounted inside the generator at the commutator end and above the commutator, or else as a separate unit.

For early type used with Frames 400 and 450—

Closes at 7.0-8.0 volts, 400-500 R. P. M.

Opens at 6.0-7.0 volts, discharge of 0.0-2.0 amperes.

Contact gap to be .013-.018 in. Adjusted by bending armature support. Gap between end of core and armature to be $\frac{1}{32}$ in. with contacts open; adjusted by screwing magnetic core in or out.

Spring tension adjusted by bending lip against which spring bears.

For early type used with Frame 760 and in which coil is held in place by brass plate—

Closes at 5.8-6.1 volts, 500 R. P. M., opens with discharge of 0.0-3.0 amperes.

Gap between open contacts to be .012-.018 in.; gap between end of core and armature with contacts closed to be .005 in. Hinge gap to be .008-.012 in.

For later types in which coil is held by a spring under the head of the adjustable core—

WESTINGHOUSE

THIRD BRUSH GENERATORS—*Continued*

Closes on 6-volt machines at 6.2-6.5 volts, 400-500 R. P. M.; on 12-volt machines at 12.4-13.0 volts, 450 R. P. M.

Opens with discharge of 0.0-3.0 amperes on either voltage.

Gap between open contacts to be .030-.035 in.; gap between end of core and armature with contacts closed to be .005 in. Hinge gap to be .005-.010 in.

STARTER: See section 2941 on Westinghouse Starting Motors.

DIAGRAMS: See Diagrams 2975, 2976, 2977, 2979, 2980, 2981 and 2982.

WESTINGHOUSE

CONSTANT VOLTAGE, CAM REGULATED GENERATOR, EXTERNAL CUT-OUT

FRAMES: 150R, 151R, 760R.

VOLTAGE: 6.

CHARGE RATES: These values to be taken with discharged battery. If battery is fairly well charged, operate starter for about ten seconds, which will give temporary effect of a discharged battery. Then turn on ignition and speed up engine, taking an immediate reading.

Frame Number	R. P. M.	Setting Volts	Amperes	Battery
150R	2000	6.5	8.0	6-volt
151R	1500	6.5	7.0	none used
760R	1800	6.5	12.0	6-volt

GENERATOR: Four pole shunt wound machine with four field coils. Two brushes set at 90 degrees from each other, negative brush at bottom, positive (grounded) brush at left hand side of commutator.

Test Terminals: Ammeter between terminal on side of housing and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field winding between lower contact of regulator and terminal on side of housing.

Field Current: For 150R, 2.0-2.5 amperes. For 151R, 2.25-2.75 amperes. For 760R, 1.75-2.25 amperes.

REGULATION: Constant voltage maintained by cam type regulator at speeds above those at which generators reach voltage for which set. Regulator is carried inside generator commutator end housing.

A pair of contacts are mounted below a voltage coil which is connected across the generator brushes (through ground). The upper contact is attached to the magnet armature and the lower contact is attached to an arm which also carries a bumper block, riding on a cam attached to the end of the armature shaft. The voltage coil tends to lift the upper contact away from the lower one. The lower one follows the cam at all times but inertia and the magnetic pull prevent the upper one from remaining in contact with the lower. The shunt field current passes through the contacts and when they are open the field current is forced through a resistance in parallel with the contacts. The length of time of contact decreases as the generator speed increases, thus maintaining a constant voltage.

The regulator spring tension is adjusted by bending the bent brass finger that forms a stop for the end of the spring. Bending the finger down increases the spring tension and raises the voltage, bending it up lowers the voltage. The voltage also depends on the gap between the magnet core end and the iron arm that holds the upper contact. A wider gap gives increased voltage; a smaller gap gives lower voltage. The gap should be .005-.010 in., smaller openings than .010 in. being preferred. On generator 151R, without a battery, this gap is set at .002 in. The gap is adjusted by screwing the magnet core up or down.

CUT-OUT: Magnetic, mounted as separate unit.

Closes at 5.8-6.1 volts. Adjusted by changing spring stop.

Opens with discharge of 0.0-3.0 amperes. Adjusted by changing armature stop.

Gap between opened contacts, .012-.018 in.; gap between end of core and armature with contacts closed, .005 in.; hinge gap, .008-.012 in.

STARTER: See Section 2941 on Westinghouse Starting Motors.

DIAGRAM: See Diagram 2984.

WESTINGHOUSE

CONSTANT VOLTAGE, CAM REGULATED GENERATOR, INTERNAL CUT-OUT

FRAMES: 761R, 762R, 780R.

VOLTAGE: 761R and 762R, 6 volts; 780R built for 6 or 12 volts.

CHARGE RATES: These values to be taken with discharged battery. If battery is fairly well charged, operate starter for about ten seconds, which will give temporary effect of a discharged battery. Then turn on ignition and speed up engine, taking an immediate reading.

Frame Number	R. P. M.	Setting Volts	Amperes	Battery
761R	1200	7.0	12.0	6-volt
762R	1800	6.5	12.0	6-volt
780R	1800	6.5	15.0	6-volt
780R	1800	13.0	8.0	12-volt

GENERATOR: Four pole shunt wound machine with four field coils. Four brushes; two positives top and bottom, joined together and grounded; two negatives at opposite sides, joined together.

Test Terminals: Ammeter between terminal (A) on side of housing and wire removed. Voltmeter between this terminal and ground.

Field Terminals: Shunt field between negative brushes and lower contact of regulator.

Terminal on front bracket (when used) is for use with the starter and is connected to the cut-out and the negative brushes.

Field Current: For 761R and 762R, 2.5-3.0 amperes. For 780R, 6 volt, 2.0-3.0 amperes. For 780R, 12 volt, 1.25-1.50 amperes.

REGULATION: Same as for preceding section.

CUT-OUT: Magnetic, mounted inside the end bracket of the generator. Tests and settings same as for preceding section on 6 volt unit.

On 12 volt cut-out, adjust spring stop to close at 11.7-12.2 volts; adjust armature stop to open with discharge of 0.0-2.5 amperes. Gaps same as for 6 volt machine.

STARTER: See Section 2941 on Westinghouse Starting Motors.

DIAGRAM: See Diagram 2983.

WESTINGHOUSE

MOTOR-GENERATOR

FRAME: 600.

VOLTAGE: 12.

CHARGE RATE: With machine hot or with fully charged battery, rates will be slightly lower.

Starts charge	900 R. P. M.	13.2 volts
2 amperes	1000 R. P. M.	14.0 volts
5 amperes	1200 R. P. M.	14.7 volts
7.7 amperes	1500 R. P. M.	15.0 volts
9 amperes	2000 R. P. M.	15.2 volts
8 amperes	3000 R. P. M.	15.0 volts

MOTOR-GENERATOR: Four pole machine with one field coil above armature and another below. Two wound poles and two consequent. Each coil contains shunt and series field windings.

Two main brushes are set at 90 degrees from each other; positive (grounded) brush at top, negative brush at left hand side. Third brush at right and below center line.

Single armature with single winding and commutator.

Test Terminals: Ammeter between large left hand terminal near top of housing in front and wire removed (connection will carry the starting current unless engine is cranked by hand). Voltmeter between this terminal and ground.

Field Terminals: Series field between negative (left hand) main brush and large terminal near top and on front of motor-generator. Shunt field between third brush and small terminal near top and on front of motor-generator.

Terminal on outer round end of commutator housing connects to positive main brush and is grounded. Small upper field terminal may also be grounded.

REGULATION: Third brush controls field current and has chief effect in limiting output. Series field also excited while generating and acts as a reversed series winding, assisting in the regulation.

Third brush is moved with armature rotation (anti-clockwise) to increase charge rate, and moved against armature rotation to reduce rate.

CUT-OUT: Some of these machines were used without any cut-out, being connected to the battery when the starting switch is closed and remaining connected as long as the switch is closed. When the engine slows down below 700 R.P.M. of the motor-generator, the machine acts as a motor and cranks the engine.

Later types have a magnetic cut-out carried in the starting switch housing. This cut-out closes at 15.0-16.5 volts and opens with a discharge of 0.0-1.0 ampere.

The spring tension is adjusted by bending the spring support, the armature gap is adjusted by bending the stop above the right hand end of the armature.

STARTER: Compound wound, four pole motor. Brush and field arrangement described under **Motor-Generator.**

Motor-Generator used on Ford cars gives following performance:
Running free, 700 R.P.M., 12.0 volts, 12.0 amperes.
7 ft.-lb. torque, 370 R.P.M., 11.0 volts, 65 amperes.
32 ft.-lb. torque, locked, 10.5 volts, 200 amperes.

Other motor-generators, Frame 600, give following:
Running free, 600 R.P.M., 12 volts, 17.5 amperes.
7 ft.-lb. torque, 375 R.P.M., 11.5 volts, 70 amperes.
31-34 ft.-lb. torque, locked, 10 volts, 200 amperes.

DIAGRAMS: See Diagrams 2987, 2988 and 2989.

WESTINGHOUSE

STARTING MOTORS

NOTE: Frames 320, 325, 330 and 532 are fitted with planetary gear reduction. Frames 380 and 390 are fitted with spur gear reduction.

Frame	Volts	Running Free			Running Torque				Lock Torque			Notes
		RPM (min)	Volts	Amps. (max.)	Ft.-Lb.	RPM (min)	Volts	Amps. (max.)	Ft.-Lb.	Volts	Amps. (max.)	
100	6	6500	5.7	45	2.3	1600	5.2	160	11	3.8	475	
101	6	4100	5.5	35-45	1.7	1750	5.5	145	14	3.9	550-650	
300	6	8000	5.2	30	1.2	2000	5.2	110	4	.....	250	
310	6	8000	5.2	40	1.7	2100	5.2	160	6	.....	375	
311	6	8000	5.2	40	1.7	2100	5.2	160	6	.....	375	
312	12	.....	.....	.....	1.9	2100	10.5	80	6	5.5	200	See a
318	6	.....	.....	.....	2.0	1400	5.5	125	11.5	4.2	400	
320	6	550	5.2	50	11.0	200	5.2	120	35	.....	250	planetary
325	6	550	5.2	50	11.0	200	5.2	120	35	.....	250	planetary
330	6	550	5.2	60	16.5	200	5.2	175	55	.....	375	planetary
380	6	425	5.2	60	30.5	105	5.2	175	110	.....	375	spur gear
390	6	245	5.2	60	50.0	65	5.2	175	155	.....	375	spur gear
500	12	.....	.....	.....	2.1	1600	10.5	120	13	5.5	350	See a
501	6	.....	.....	.....	3.1	750	5.2	100	10	2.6	250	
502	6	.....	.....	.....	3.1	1200	5.2	170	10	2.6	375	
503	6	.....	.....	.....	3.1	900	5.2	125	10	2.6	300	
506	6	.....	.....	.....	3.1	900	5.2	125	10	2.6	300	
507	12	.....	.....	.....	3.1	2200	10.5	160	13	5.5	500	See a
510	6	3600	6.0	20	1.5	1100	5.2	80	5	.....	200	
532	6	320	5.2	40	30	115	5.2	175	80	4.2	375	See b
700	6	3500	5.5	40	2.5	1200	5.5	130	12.5	4.0	400	See c
710	6	3500	5.5	35-45	2.5	1250	5.5	150	14	4.0	450	
710	12	3800	5.6	35-50	2.5	2500	10.5	170	14	4.0	450	See a
710	6	6000	5.7	35	1.2	2000	5.5	100	14	4.0	460	See a-d
710	12	3200	5.5	45-60	.....	.....	.....	.....	.....	4.0	500	See a-e
711	6	5500	5.8	35	3.0	1300	5.2	160	15	3.7	475	
750	6	3500	5.5	40	3.5	1050	5.5	170	17.5	4.2	500	See c
751	12	3800	5.5	38-52	3.5	2400	10.5	200	21	4.8	650	See a-f
751	12	3800	5.5	38-52	.....	.....	.....	.....	.....	4.0	550	See a-d
751	6	5000	5.8	38-52	3.5	1200	5.0	185	20	3.0	570	
755	12	3000	5.5	50-70	3.5	1250	10.5	154	20	5.5	500	See a
755	12	3500	5.5	35-55	3.5	2200	10.5	195	20	5.5	575	See a
775	6	3600	5.9	32	4.5	950	5.2	150	20	3.9	450	See c
776	6	3500	5.5	35-50	4.0	1000	5.2	170	22	3.2	570	
777	6	5000	5.7	60	3.5	1250	5.1	175	20	3.1	575	See c
778	6	3500	5.7	60	5.0	1000	5.0	225	26	2.7	670	
33AB	6	6000	5.7	35	1.7	1700	5.5	145	13	3.7	475	

NOTE a—Never run 12-volt motors with no load at more than 6.0 volts.

NOTE b—Planetary gear reduction. When driving the clutch from the gear box end, the armature should not revolve.

NOTE c—Magnetic pinion shift. Pinion must be pulled in with not to exceed the following voltages: On 700 and 750, 3.75 volts; on 775, 3.5 volts; on 777, 4.0 volts; 125 amperes limit on all motors. The pinion must not be held in by the running free current.

NOTE d—Outboard two bearing.

NOTE e—Outboard three bearing.

NOTE f—Inboard bearing.

WINDINGS: These are arranged in three different ways—

1—Where all field coils are connected in series and thence in series with the armature.

2—Where two coils are connected in parallel and the two sets connected in series with the armature.

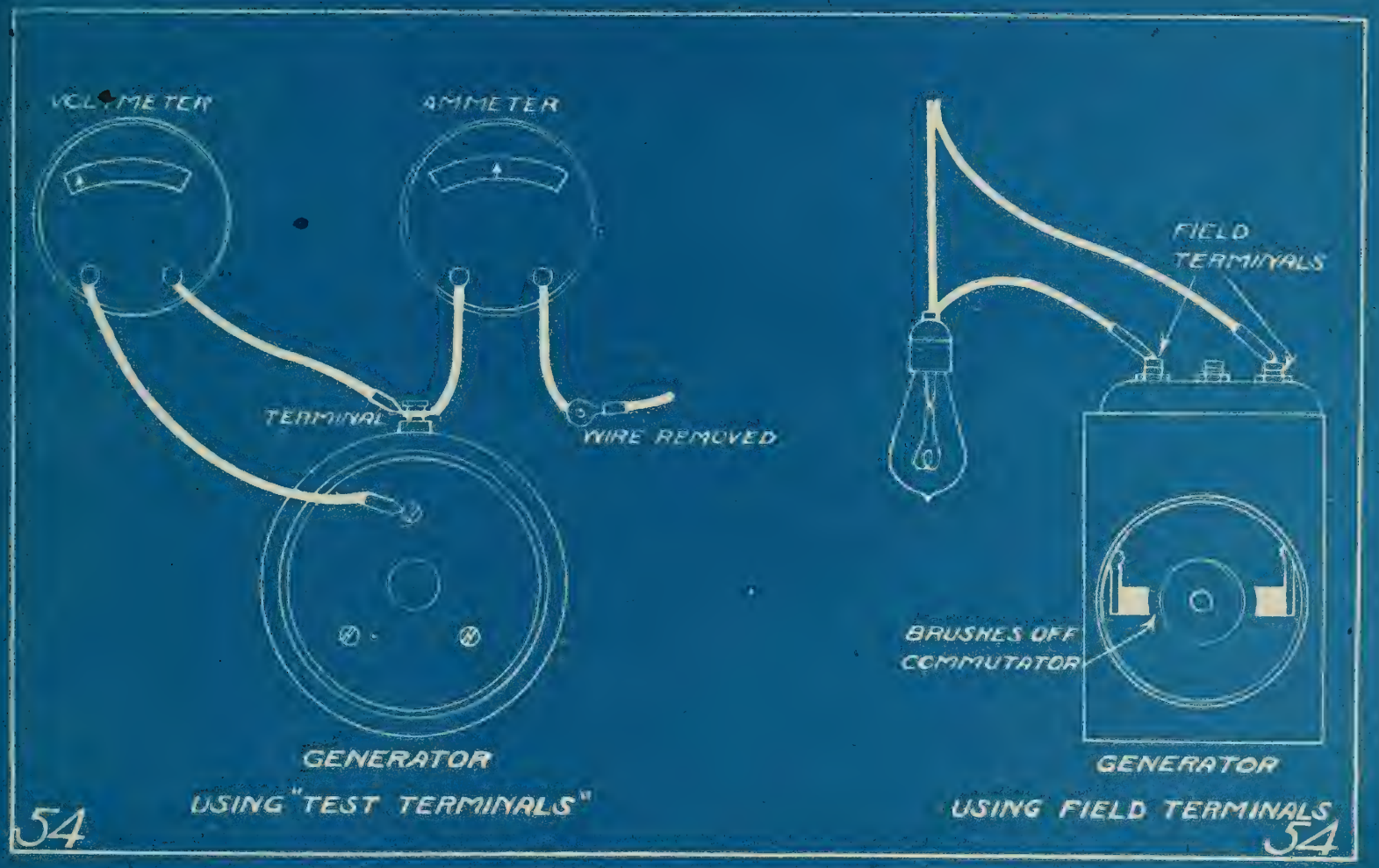
3—Similar to **2** above, except that the positive ends of the field coils are permanently grounded within the frame.

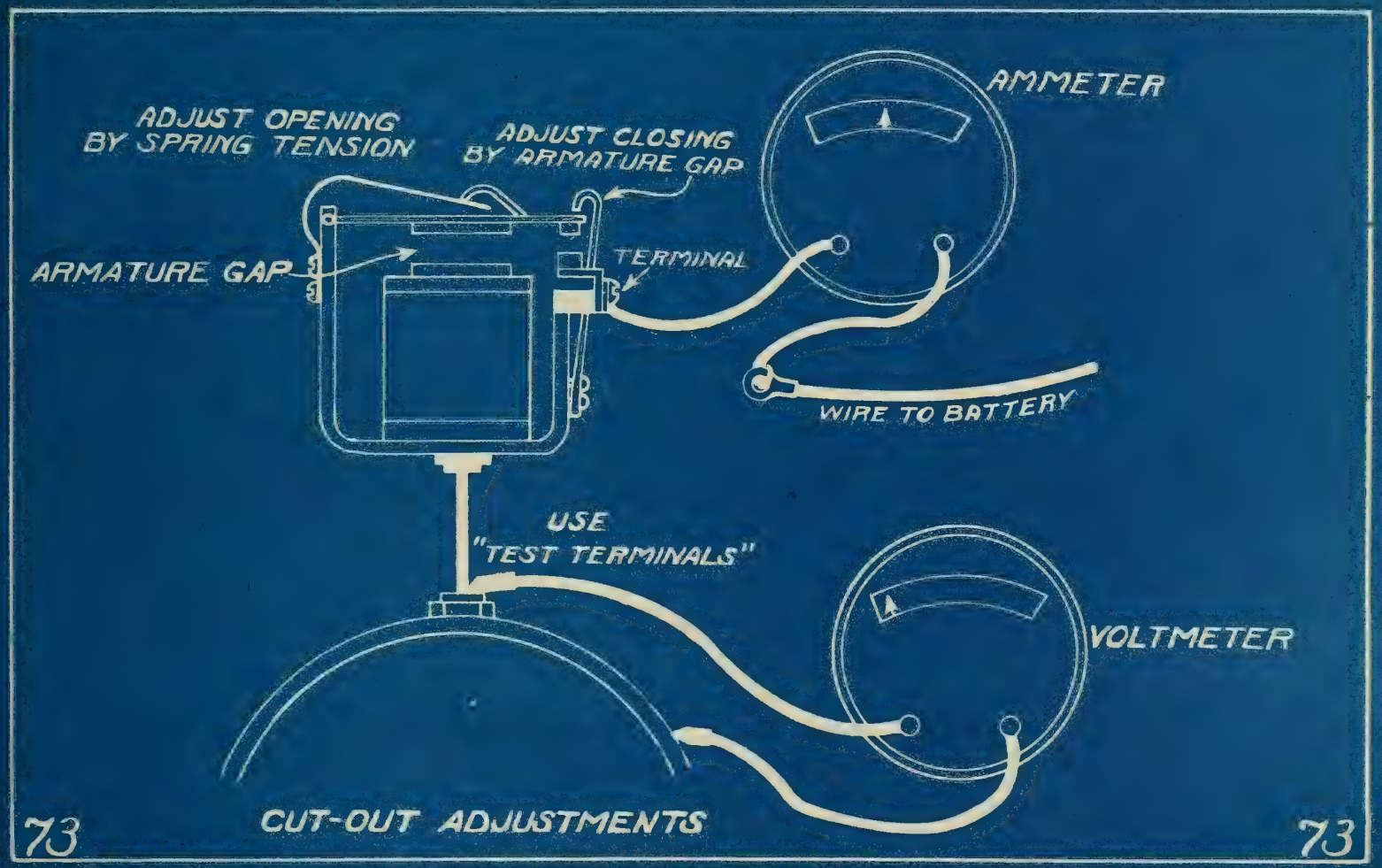
MAGNETIC GEAR SHIFT: These motors are of the regular series types, with a shifting magnet mounted on one end. The armature shaft is hollow and on the end of this shaft is a splined pinion. The pinion is slid along the shaft by a rod passing through the hollow part and with the other end of this rod forming the core of the magnet. A spring holds the pinion clear of the flywheel with the motor idle. Closing the starting switch rotates armature and pinion. The high current through the magnet drives the shift rod through the shaft and meshes the pinion; the heavy starting current holding it in mesh. With the engine started, the current through the motor falls off until it is too low to cause the magnet to hold the pinion in mesh and the spring returns it to the idle position.

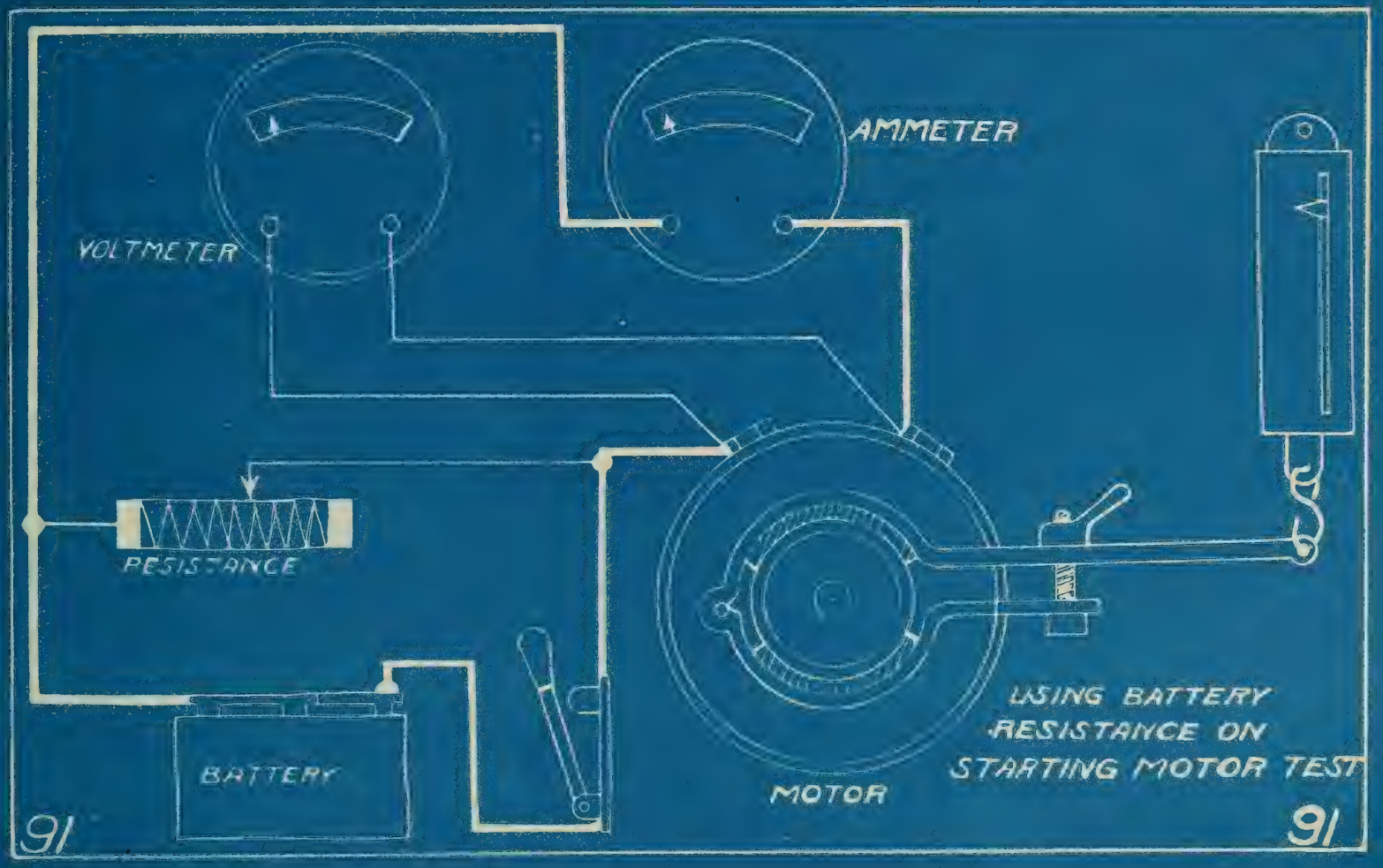
On older types of Pierce-Arrow and Locomobile the shifting coil is in a separate case but the operation is similar.

MAGNETIC SWITCH: With both types of magnetic gear shift, a magnetic starting switch is used. The switch includes a solenoid and plunger, carrying a contact disc, which closes the main starting circuit when the solenoid is energized. A dash button has one side grounded and the other side connected to the switch magnet. The other side of the switch magnet is connected to an additional terminal on the generator, this terminal connecting to the brushes between brushes and cut-out. The operation is described under Section 2904.

DIAGRAMS: See Diagrams 2955, 2956 and 2990.

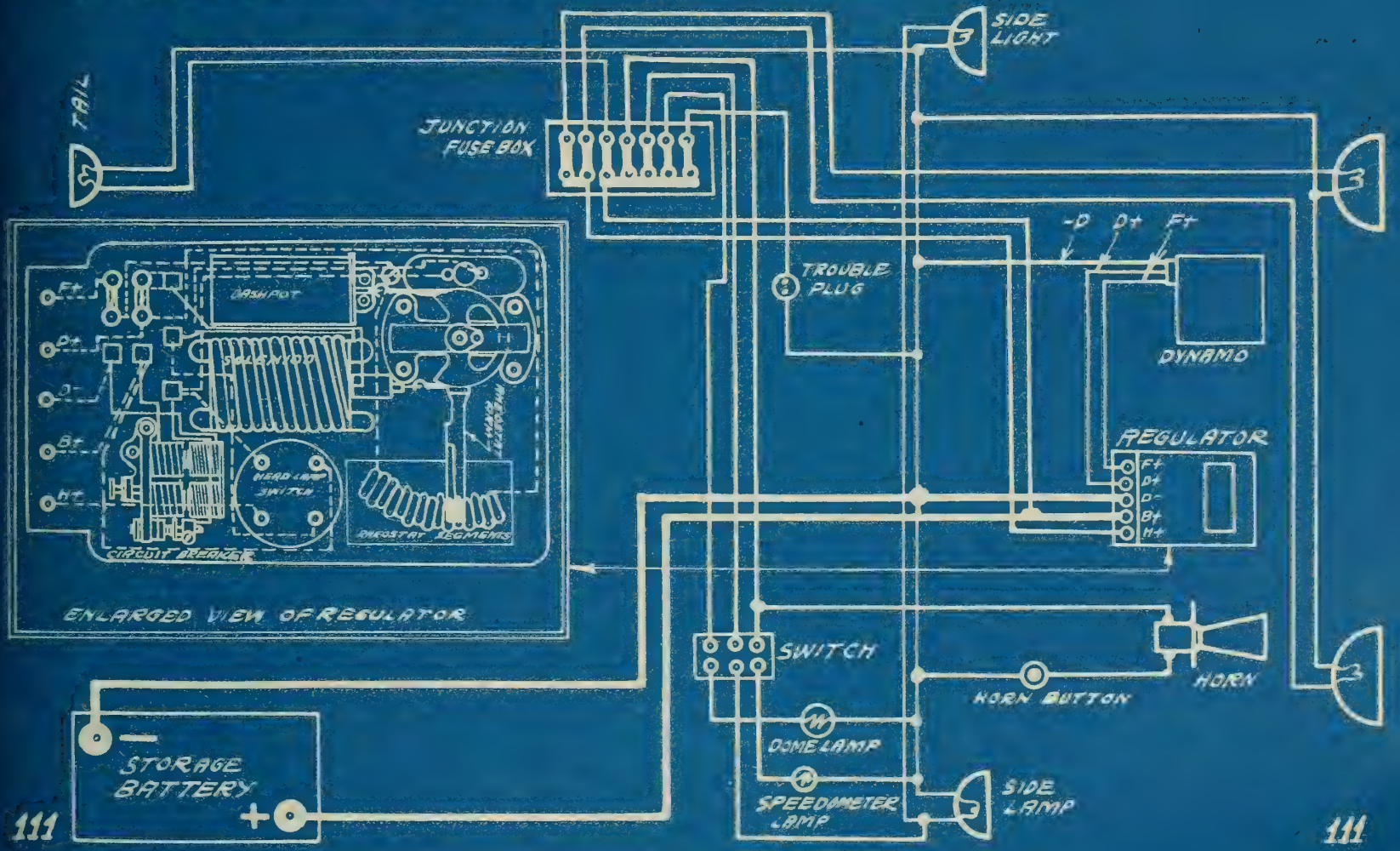

VOLTMETER
AMMETER
TERMINAL
WIRE REMOVED
GENERATOR
USING "TEST TERMINALS"
54
FIELD TERMINALS
BRUSHES OFF COMMUTATOR
GENERATOR
USING FIELD TERMINALS
54


AMMETER
ADJUST OPENING
BY SPRING TENSION
ADJUST CLOSING
BY ARMATURE GAP
ARMATURE GAP
TERMINAL
WIRE TO BATTERY
USE
"TEST TERMINALS"
VOLTMETER
73
CUT-OUT ADJUSTMENTS
73


AMMETER
VOLTMETER
RESISTANCE
BATTERY
MOTOR
USING BATTERY
RESISTANCE ON
STARTING MOTOR TEST
91
91

ADLAKE STANDARD WIRING SYSTEM

SHOWING JUNCTION FUSE BOX IN LIGHTING CIRCUITS



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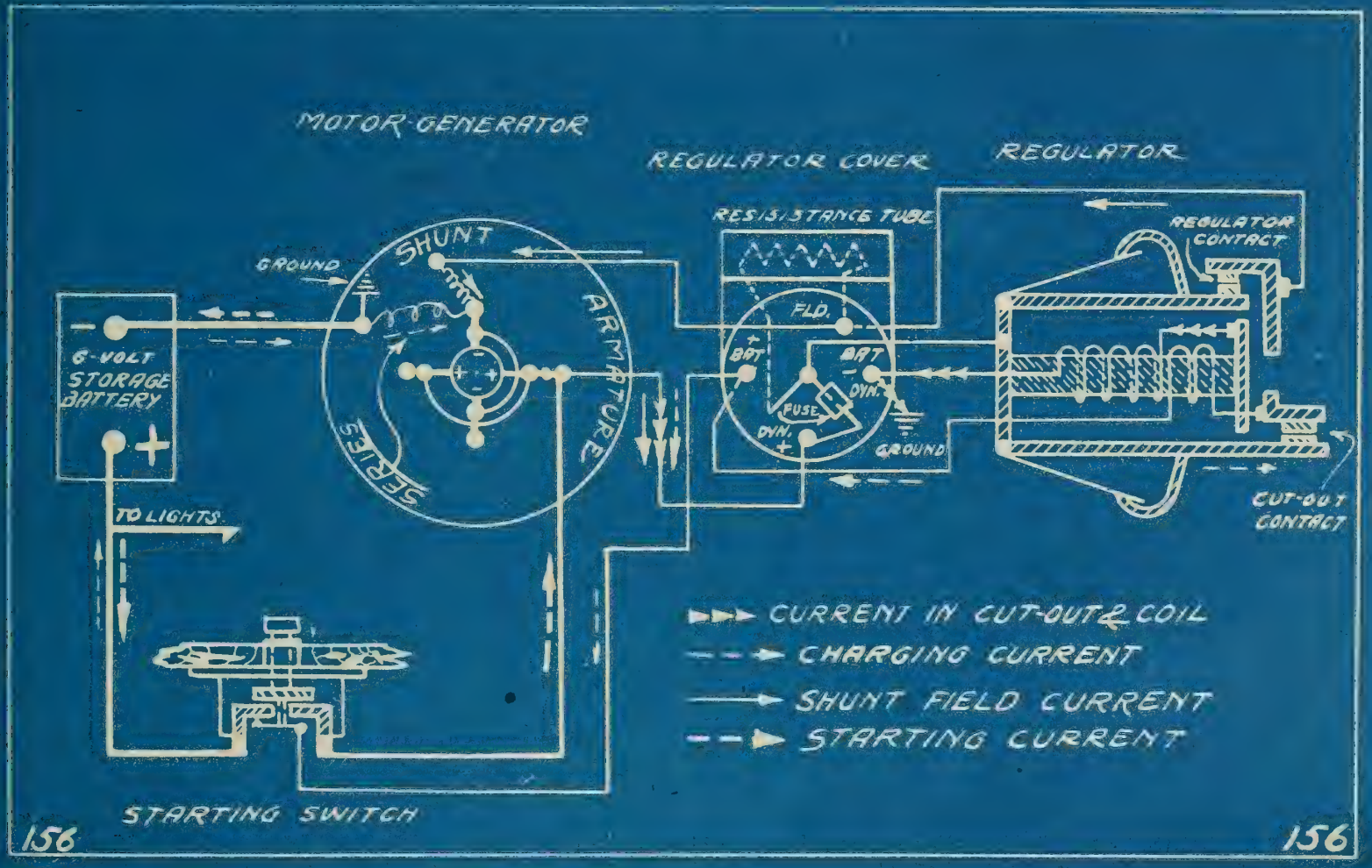
ALLIS-CHALMERS - SINGLE UNIT - INTERNAL WIRING

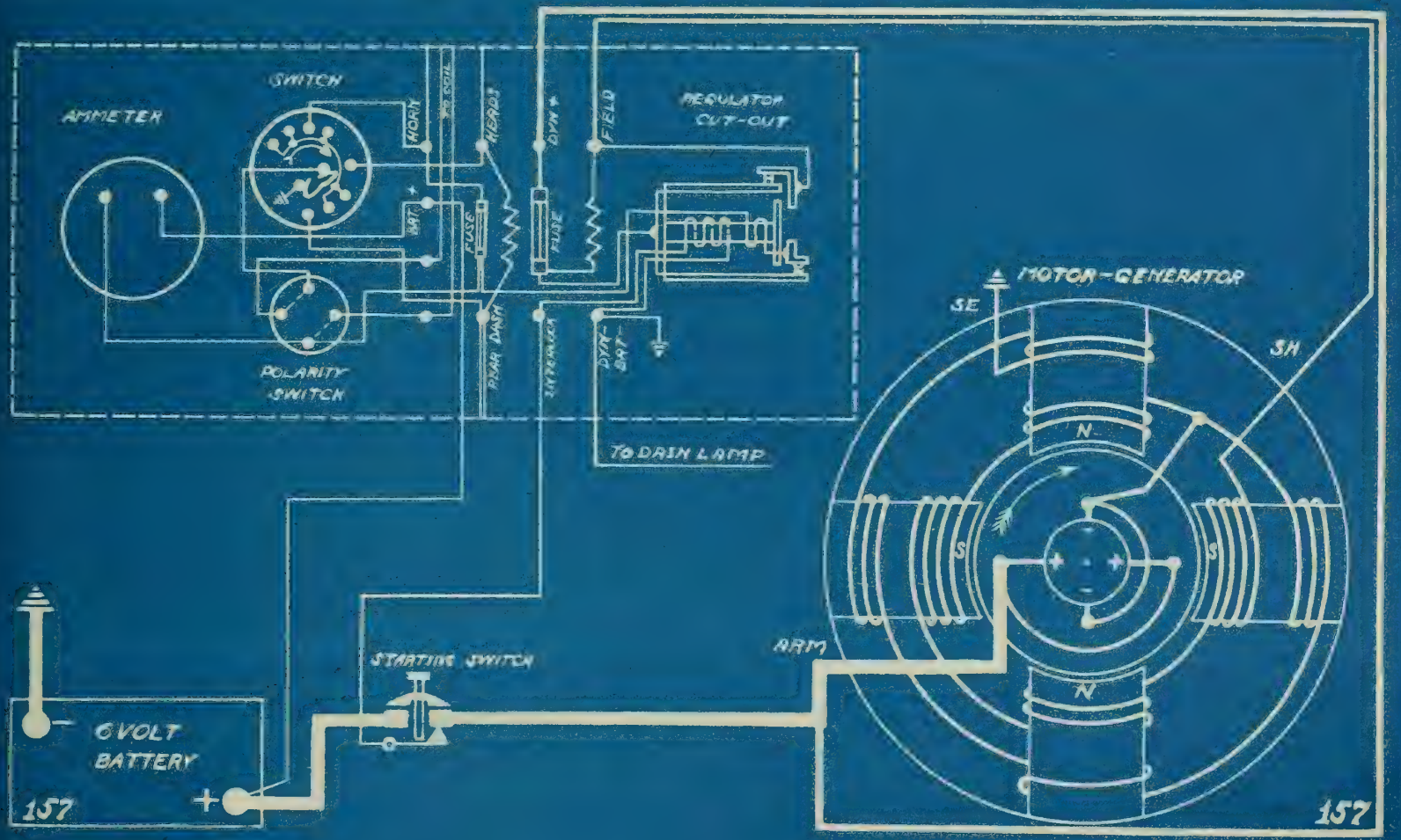
EARLY MODEL



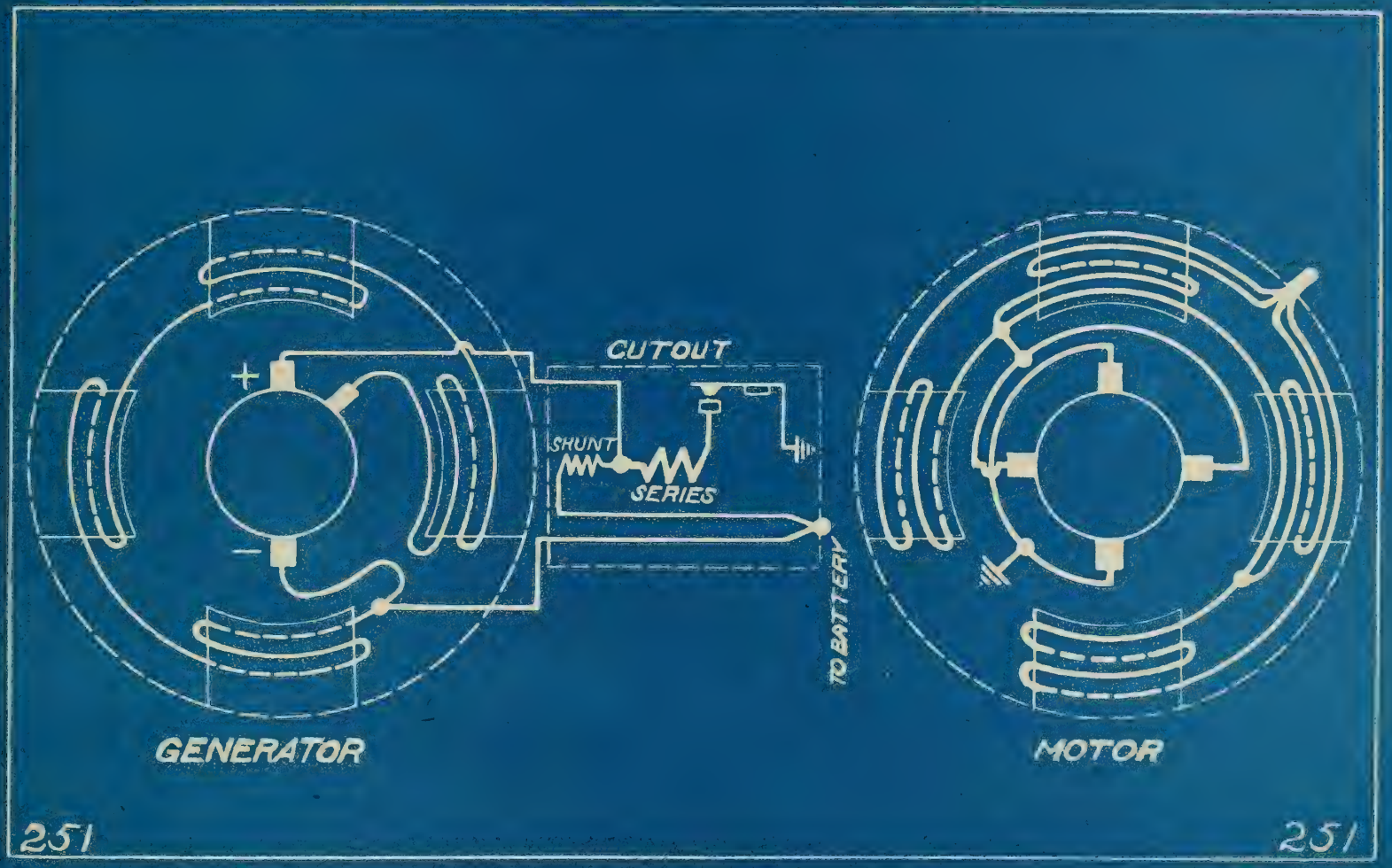
156

ALLIS-CHALMERS-SINGLE UNIT INTERNAL WIRING

WITH B & S INSTRUMENT PANEL

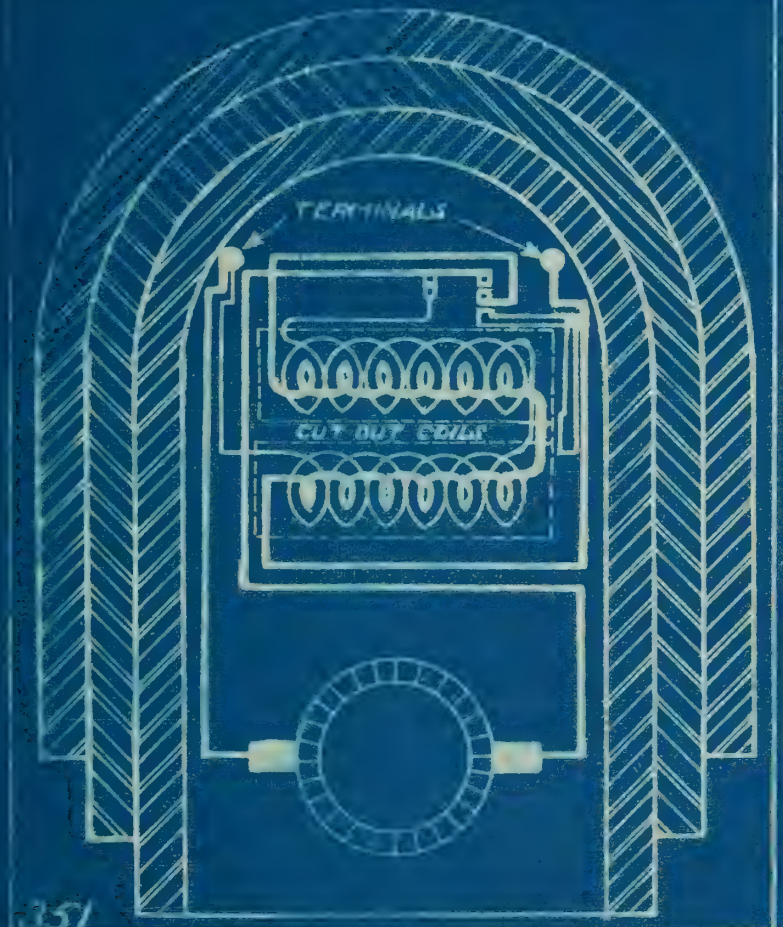


ATWATER KENT INTERNAL CIRCUITS



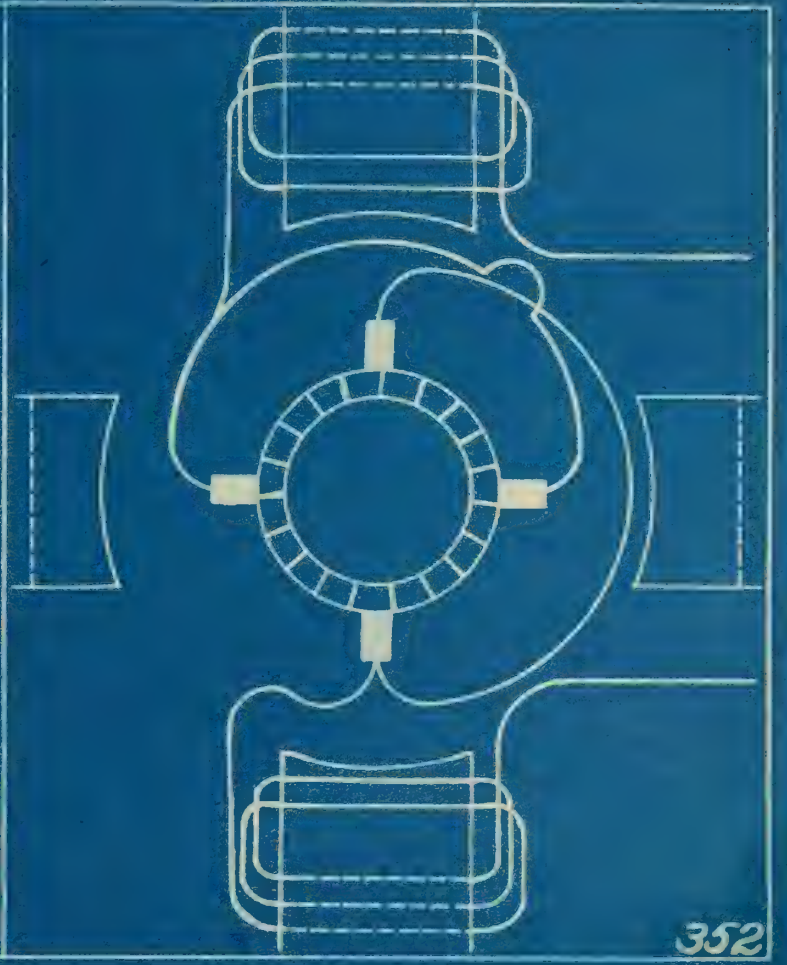
AUTO-LITE INTERNAL CIRCUITS

PERMANENT MAGNET GENERATOR



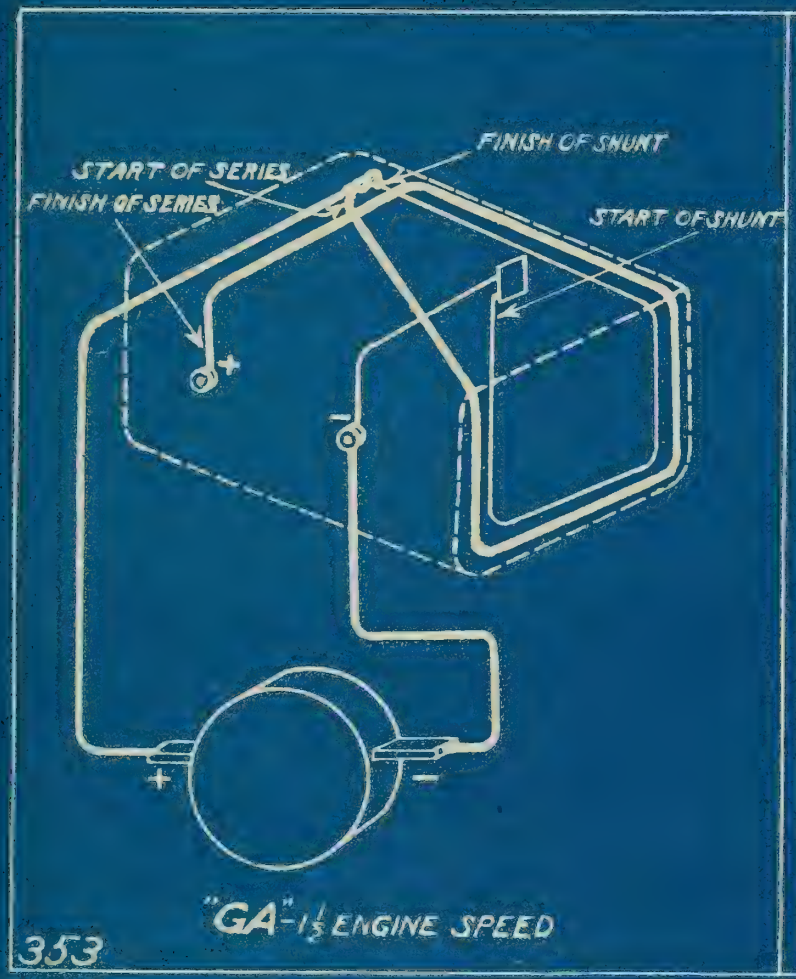
351

MODEL "M" MOTOR



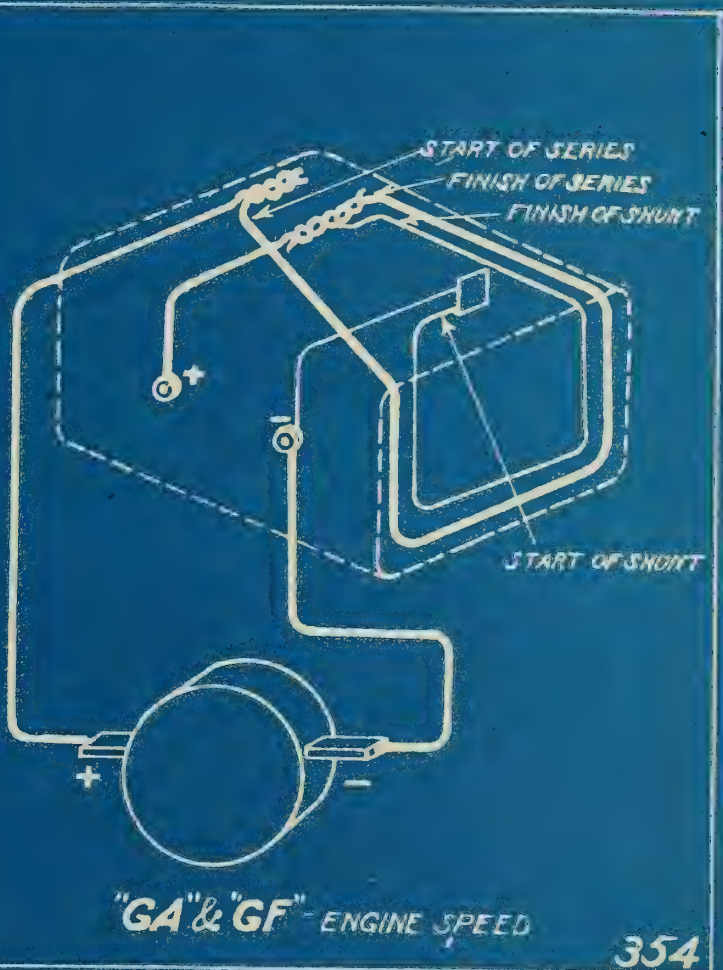
352

AUTO-LITE GENERATORS



"GA"-1½ ENGINE SPEED

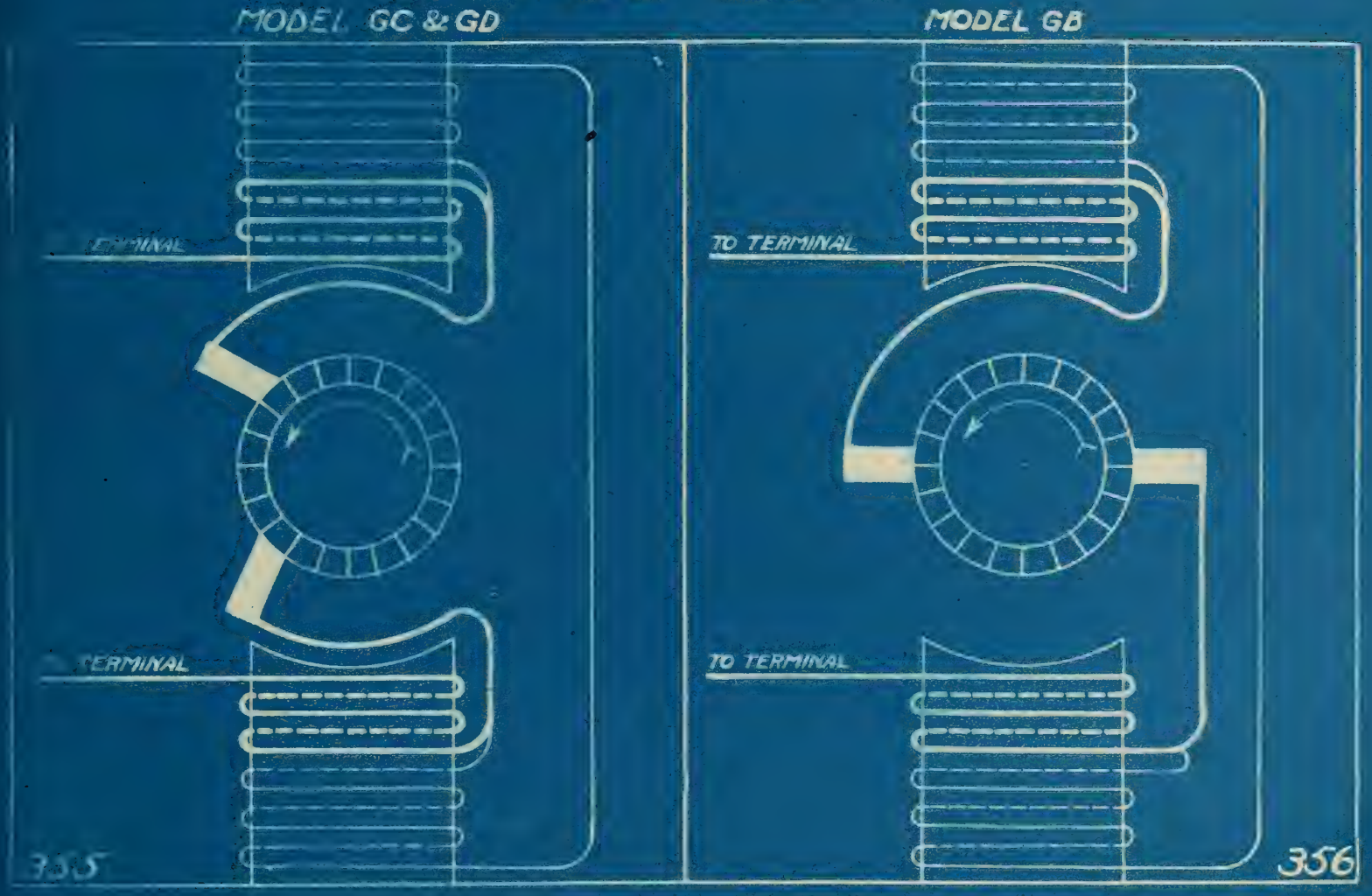
353



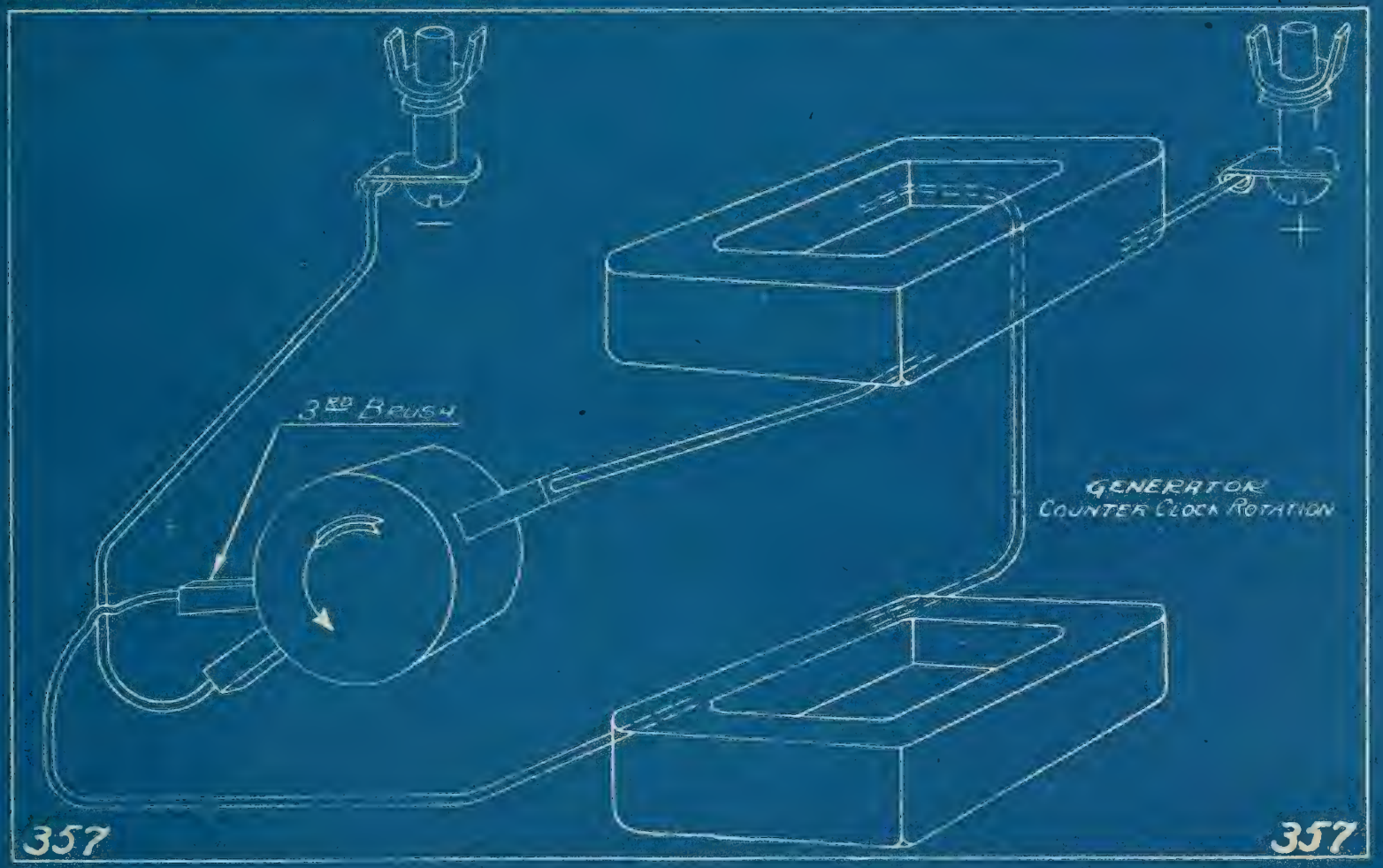
"GA" & "GF" - ENGINE SPEED

354

AUTO-LITE GENERATORS

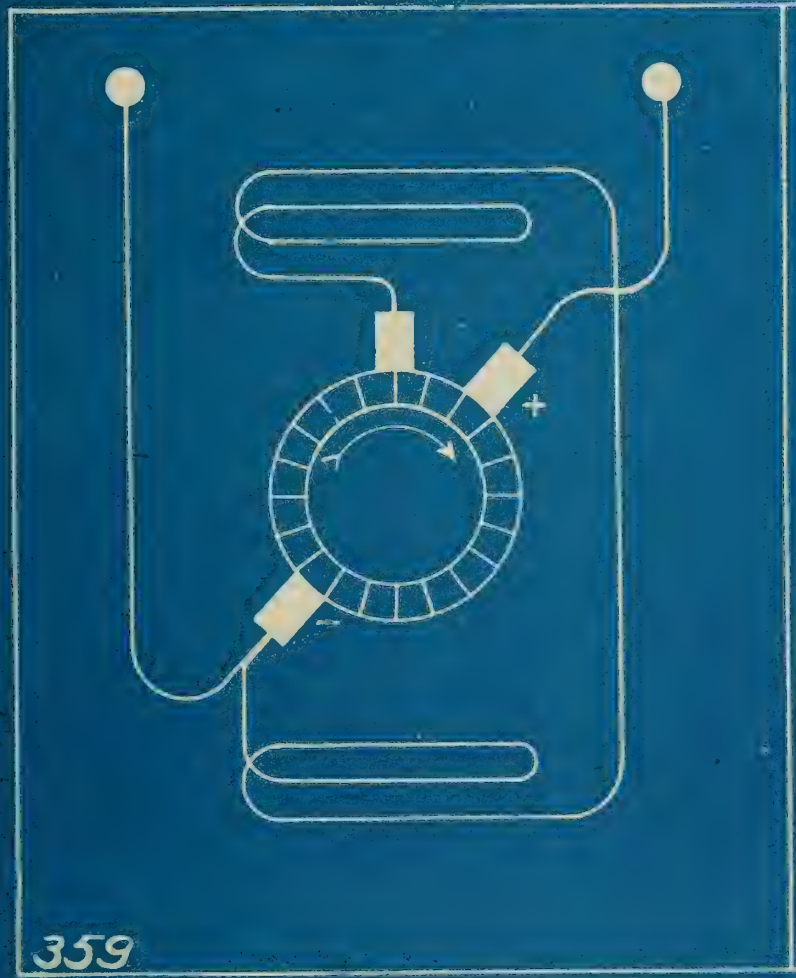


AUTO-LITE GH GENERATOR
INTERNAL CONNECTIONS



AUTO-LITE GENERATORS

MODEL GH



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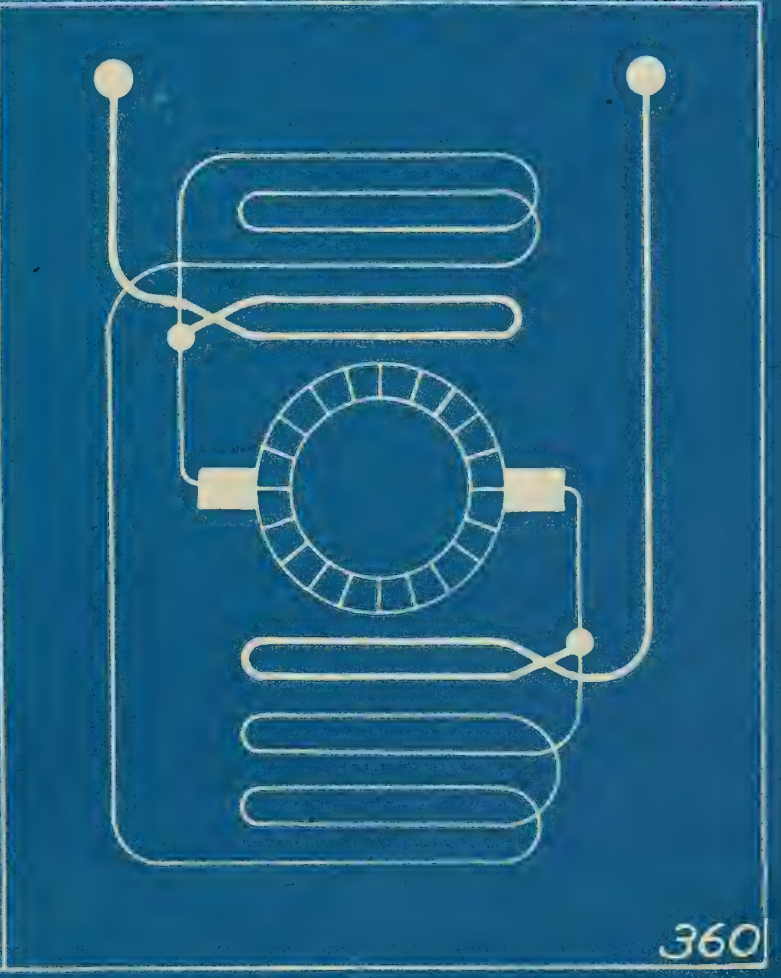
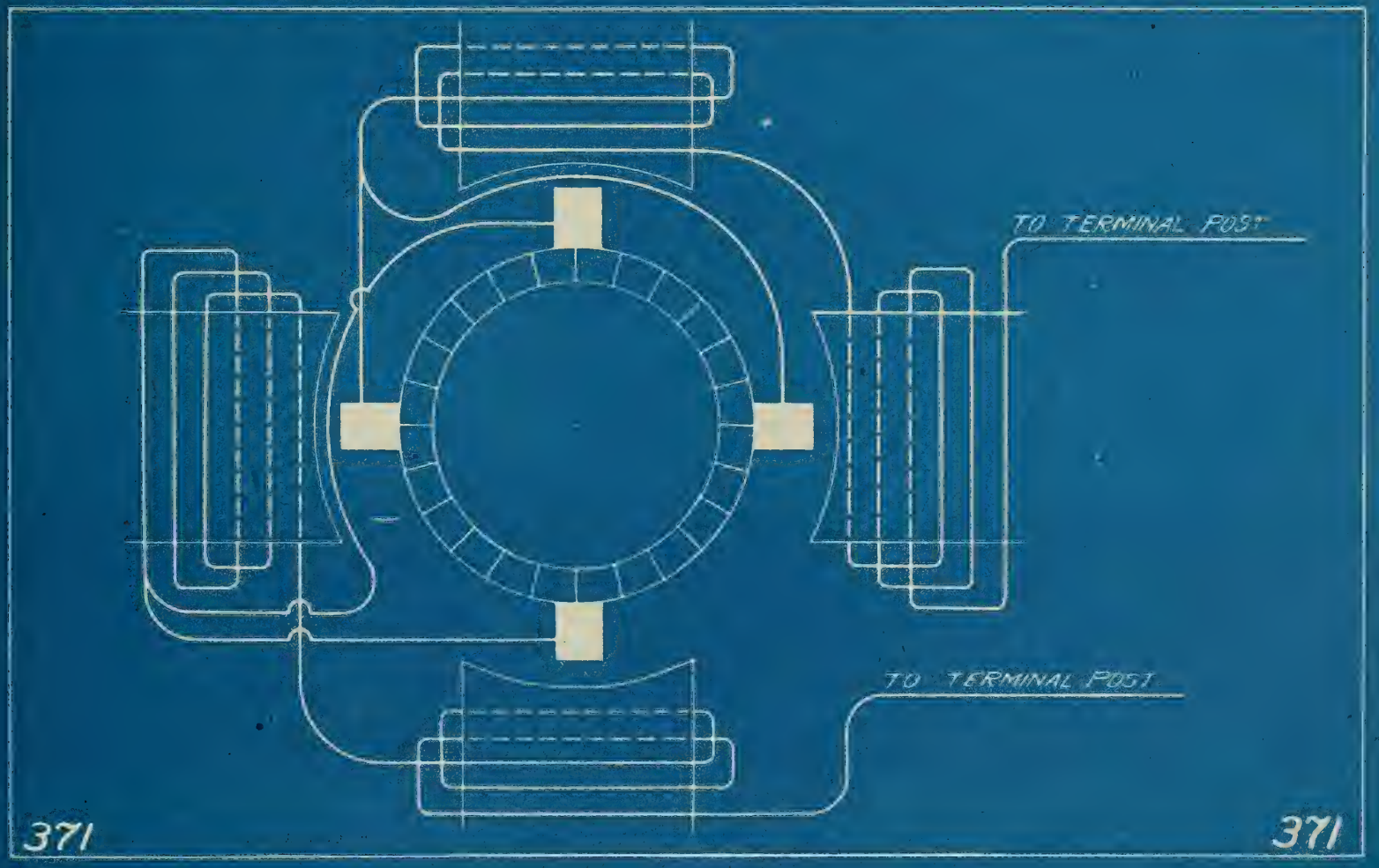
MODEL GG

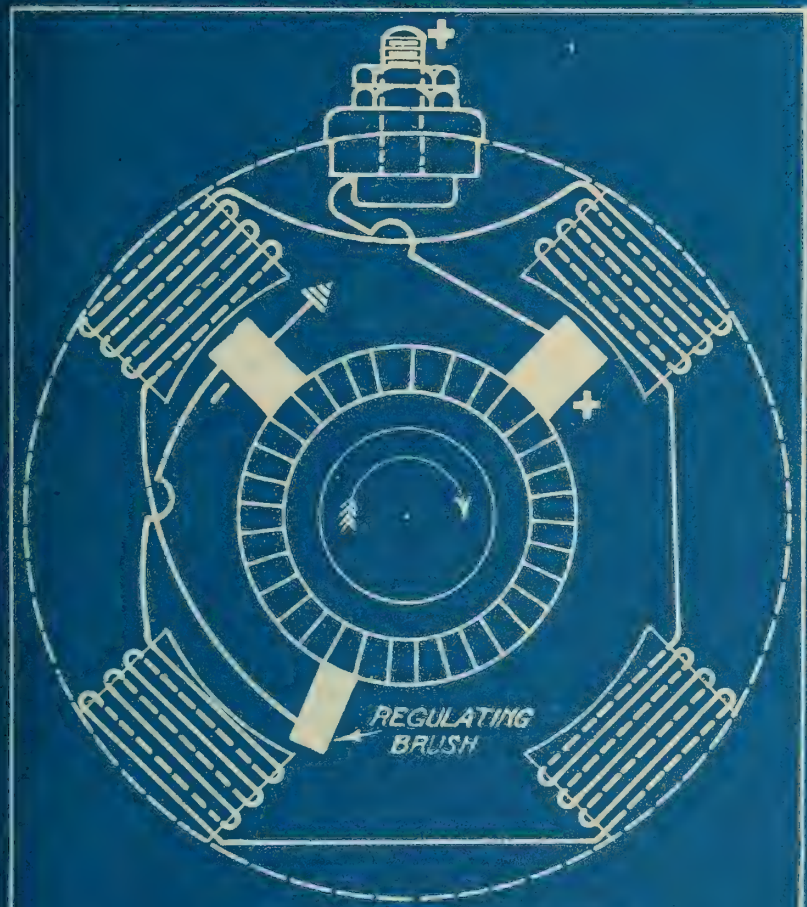


360

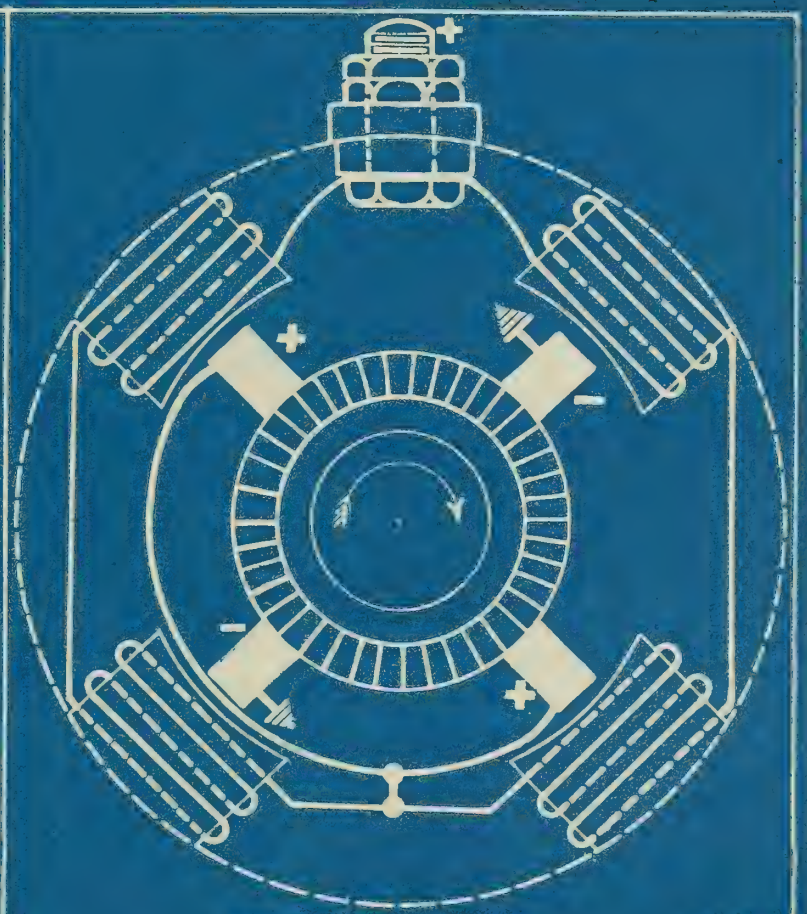
AUTO-LITE MD-MC-ME-MF-MOTORS
INTERNAL CIRCUITS



AUTO-LITE INTERNAL CIRCUITS

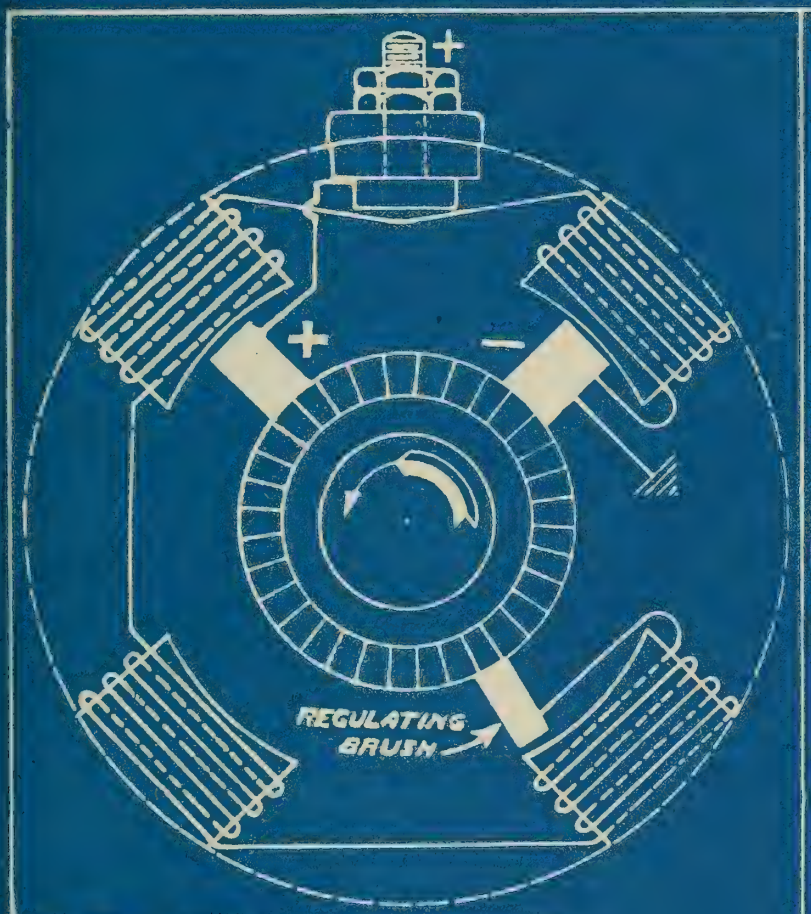


373 GJ & GK GENERATORS

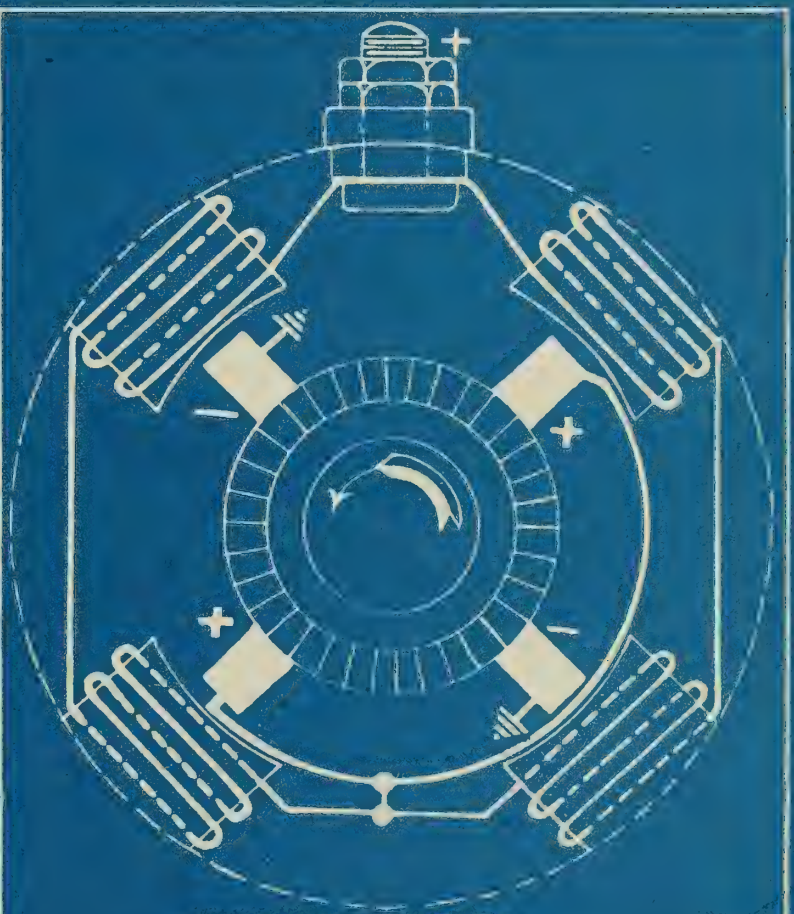


MG & MH MOTORS 374

AUTO-LITE INTERNAL CIRCUITS

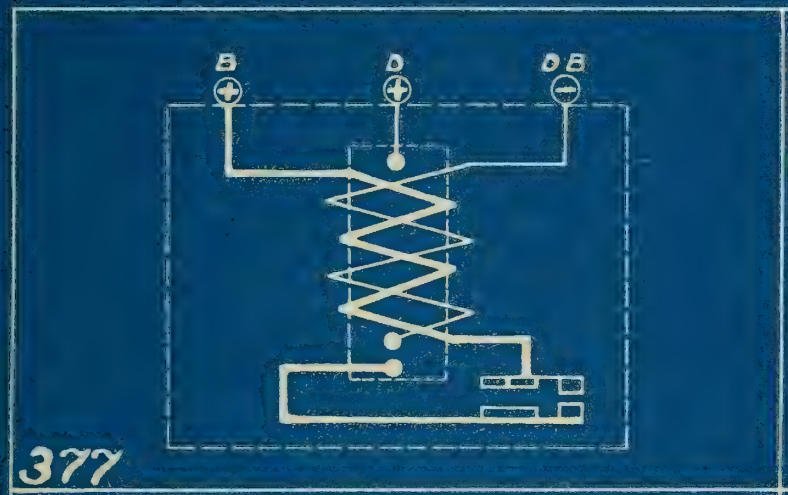


375 GJ & GK GENERATORS



MG & MH MOTORS 376

AUTO-LITE CUTOUTS



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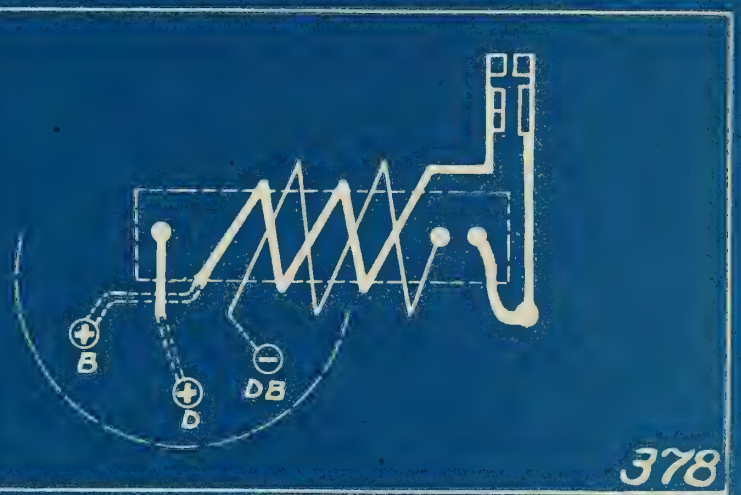

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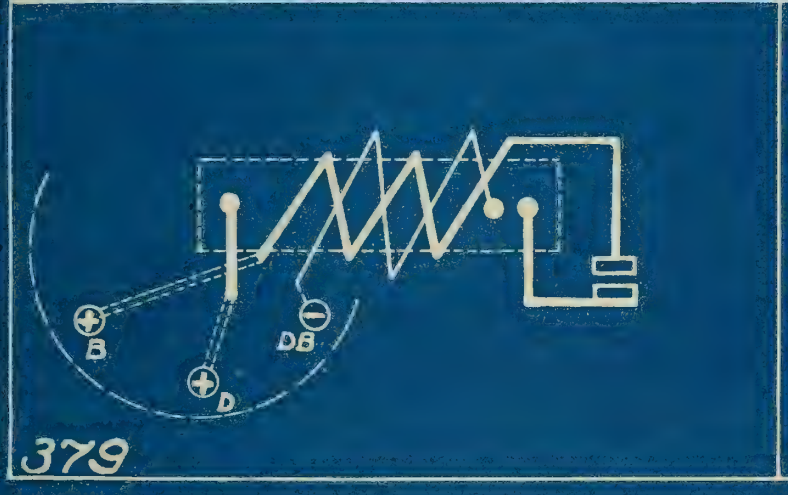

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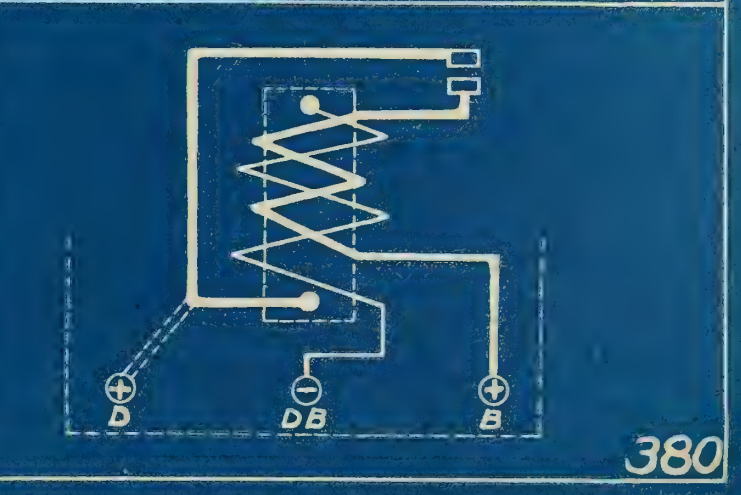
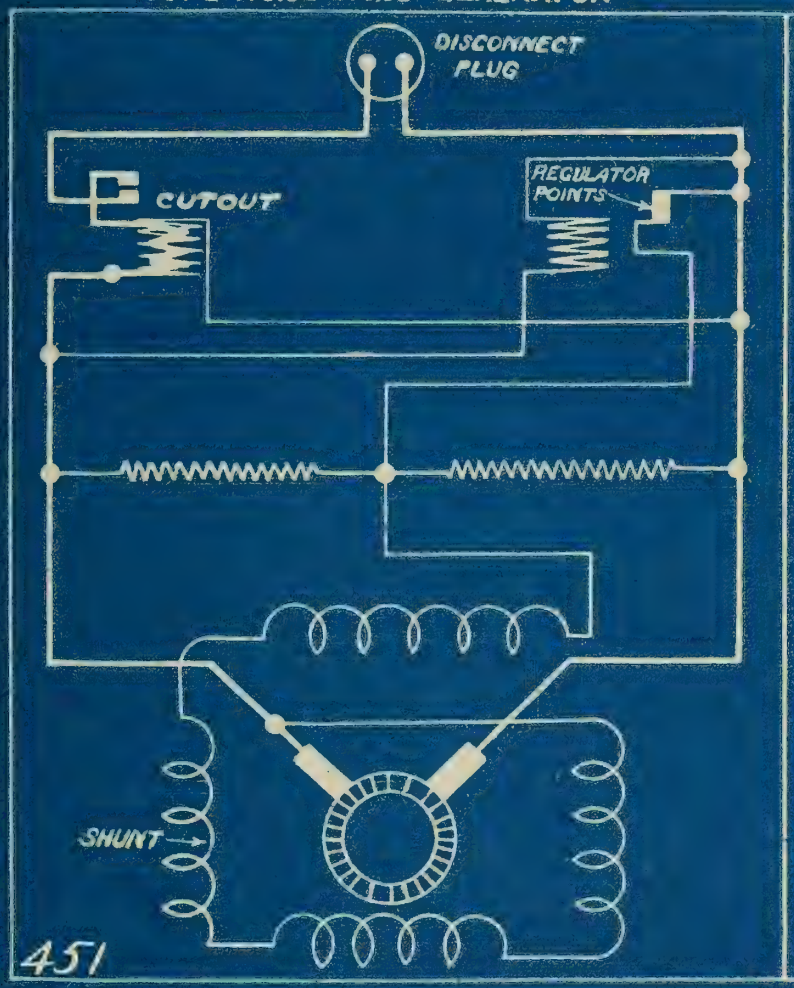


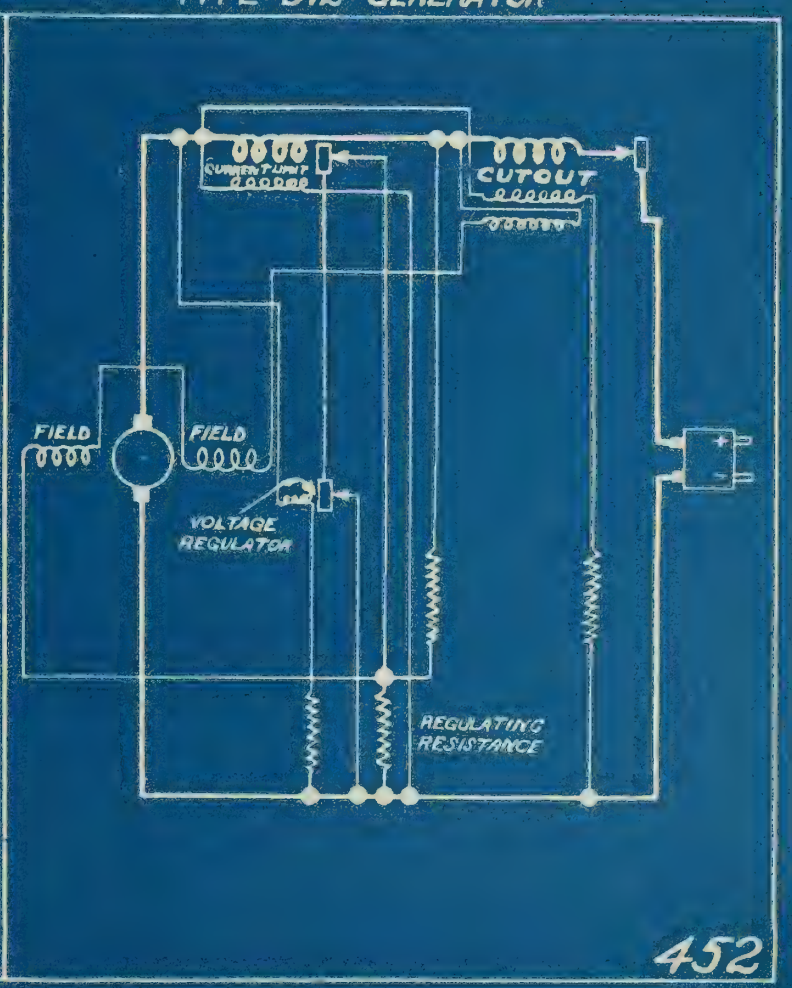
380

BIJUR INTERNAL CIRCUITS

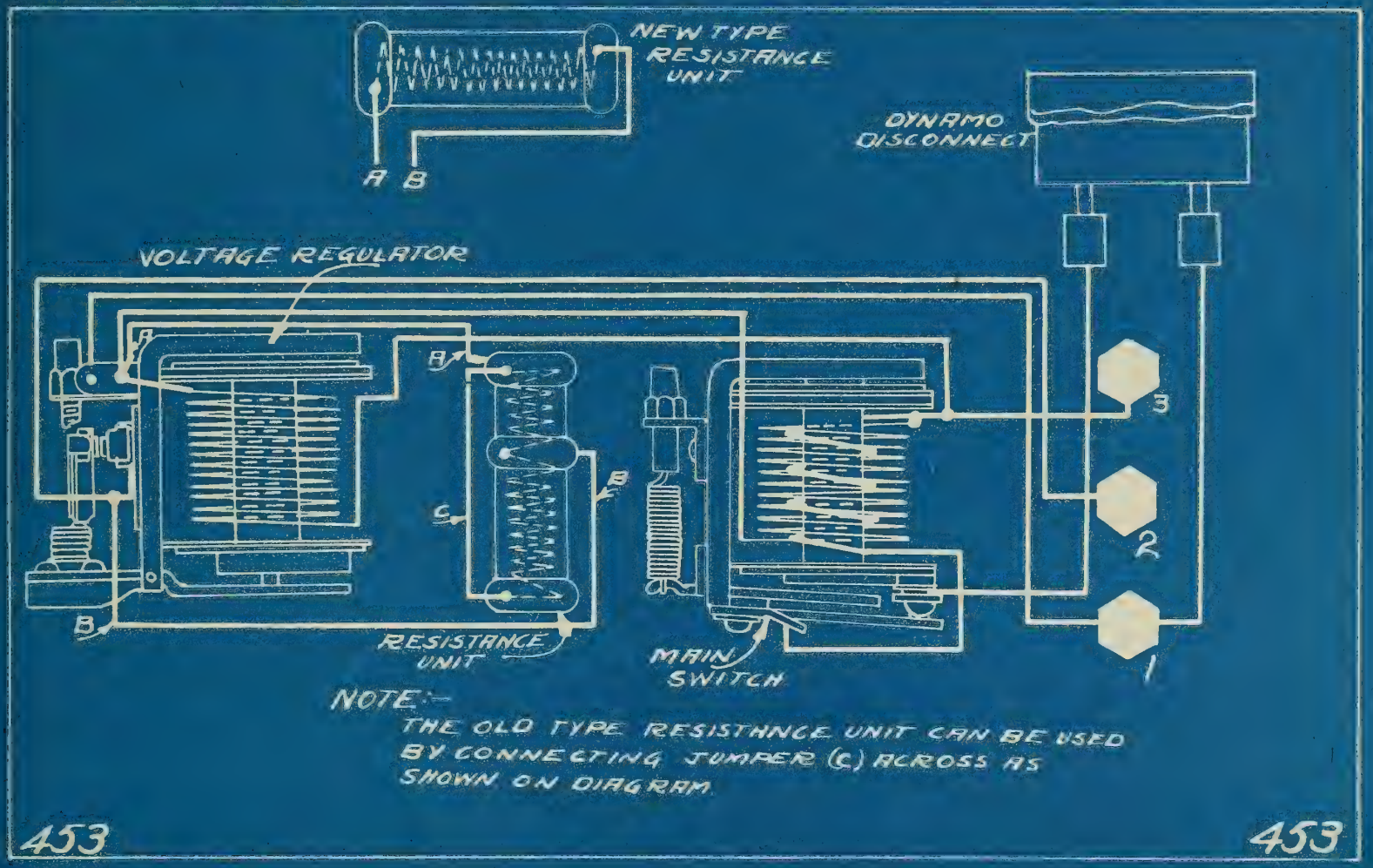
TYPE-K620-K628-GENERATOR



TYPE-D12-GENERATOR



BIJUR 1918 DEMOUNTABLE TYPE VOLTAGE REGULATOR
INTERNAL CIRCUITS

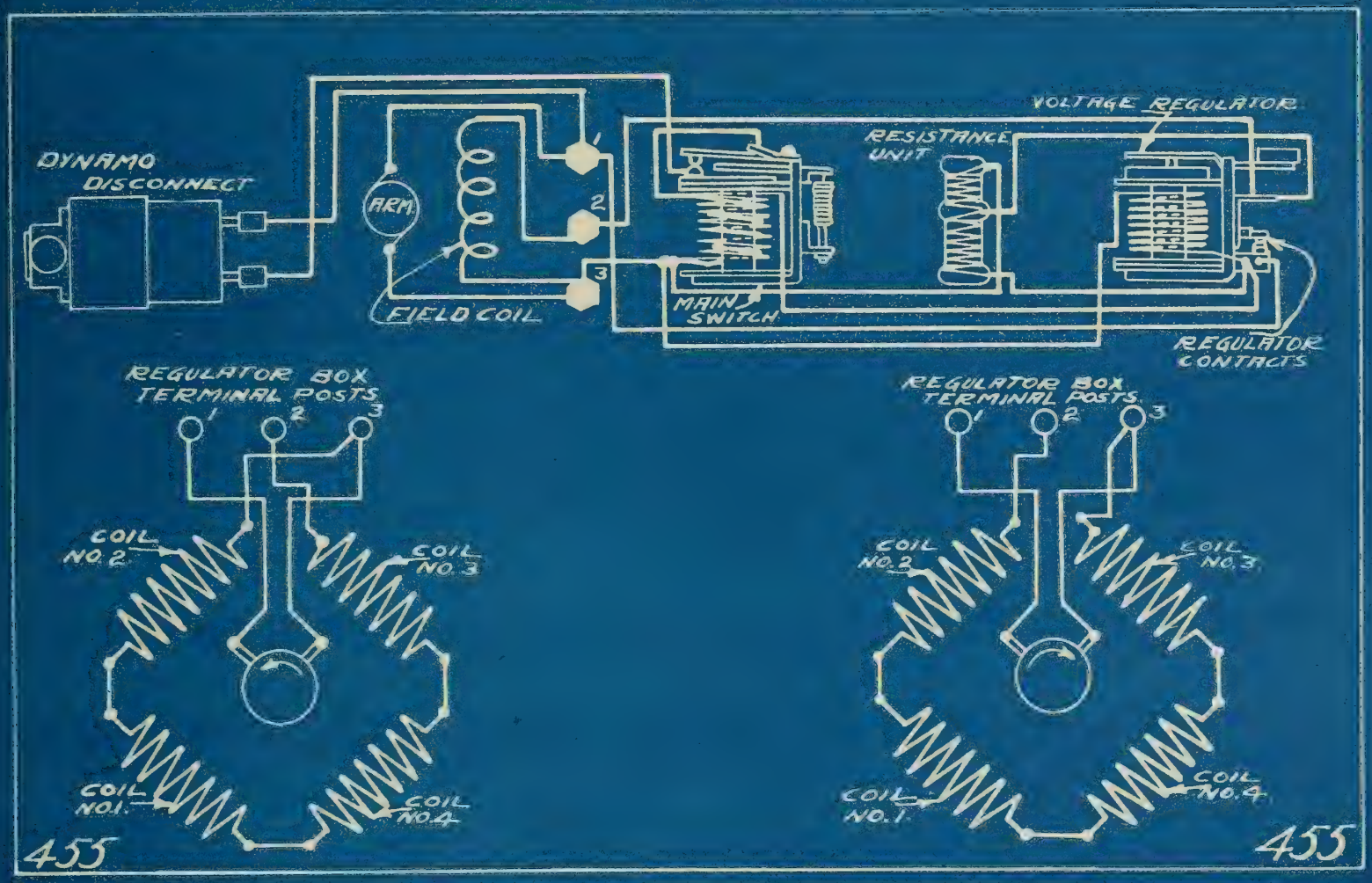


NOTE:-
THE OLD TYPE RESISTANCE UNIT CAN BE USED BY CONNECTING JUMPER (C) ACROSS AS SHOWN ON DIAGRAM.

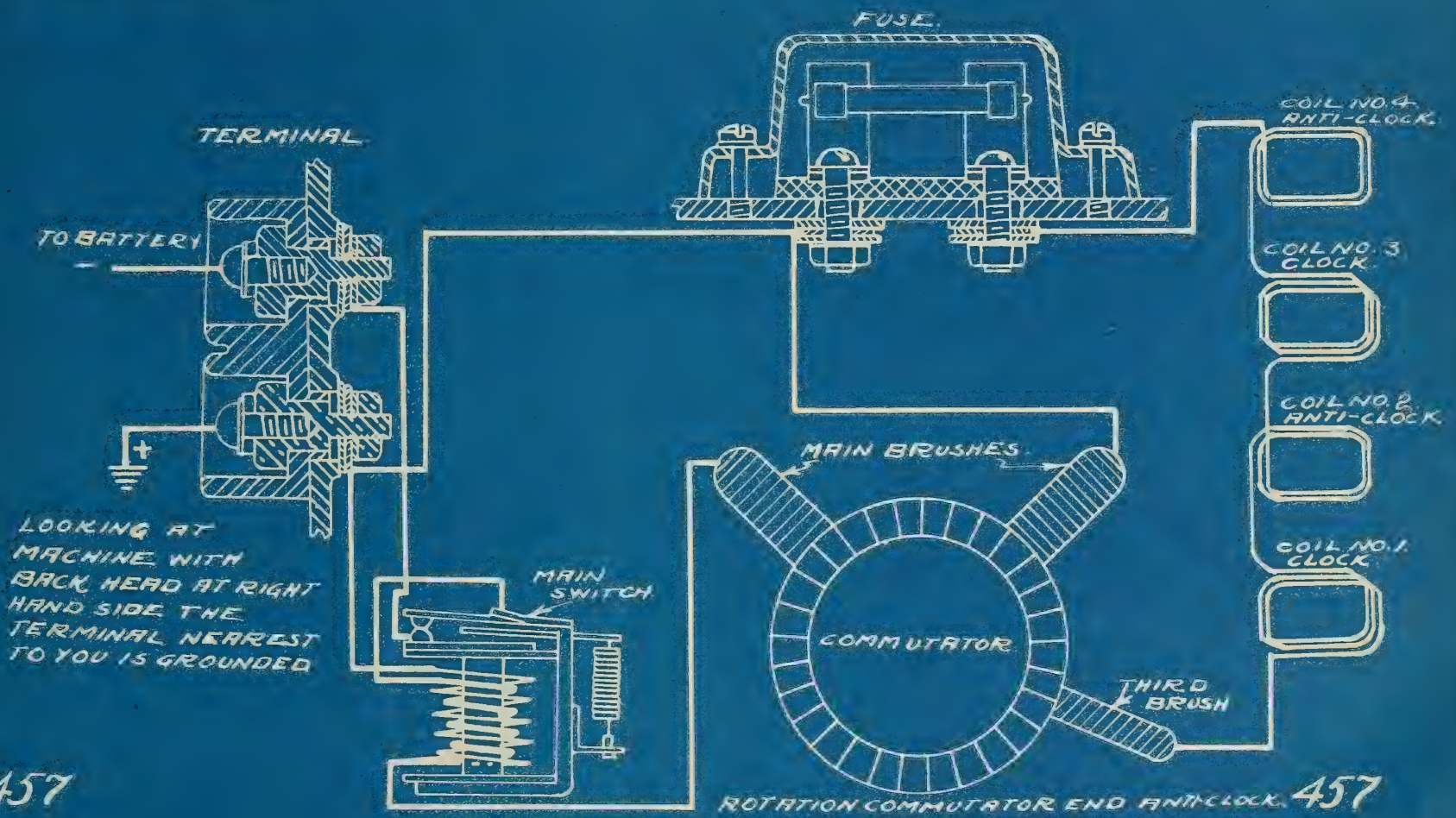
453

BIJUR GENERATOR WITH REGULATOR

INTERNAL CIRCUITS STANDARD CONNECTIONS



BIJUR TWO TERMINAL TYPE L 61 GENERATOR
INTERNAL CIRCUITS



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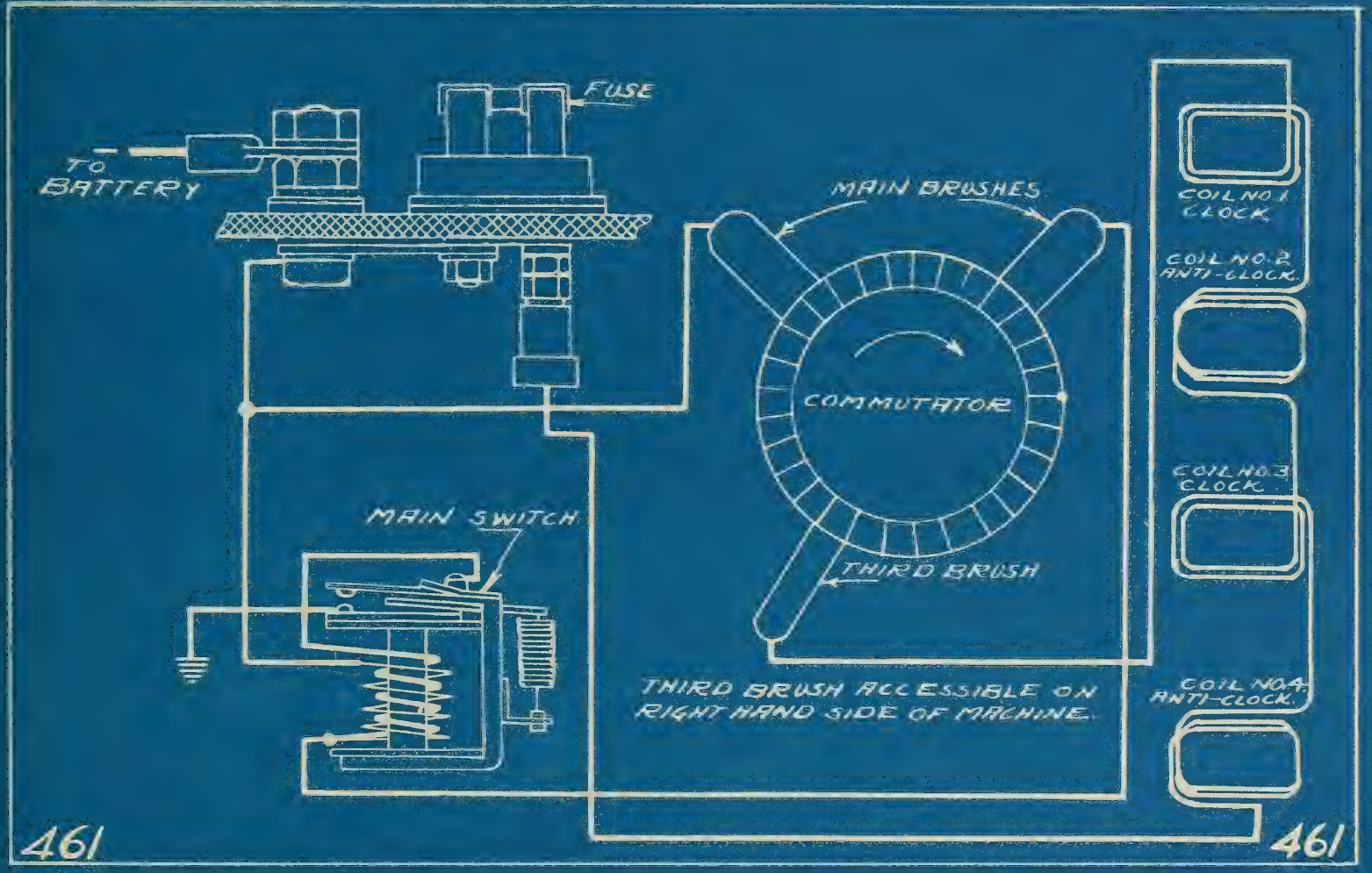
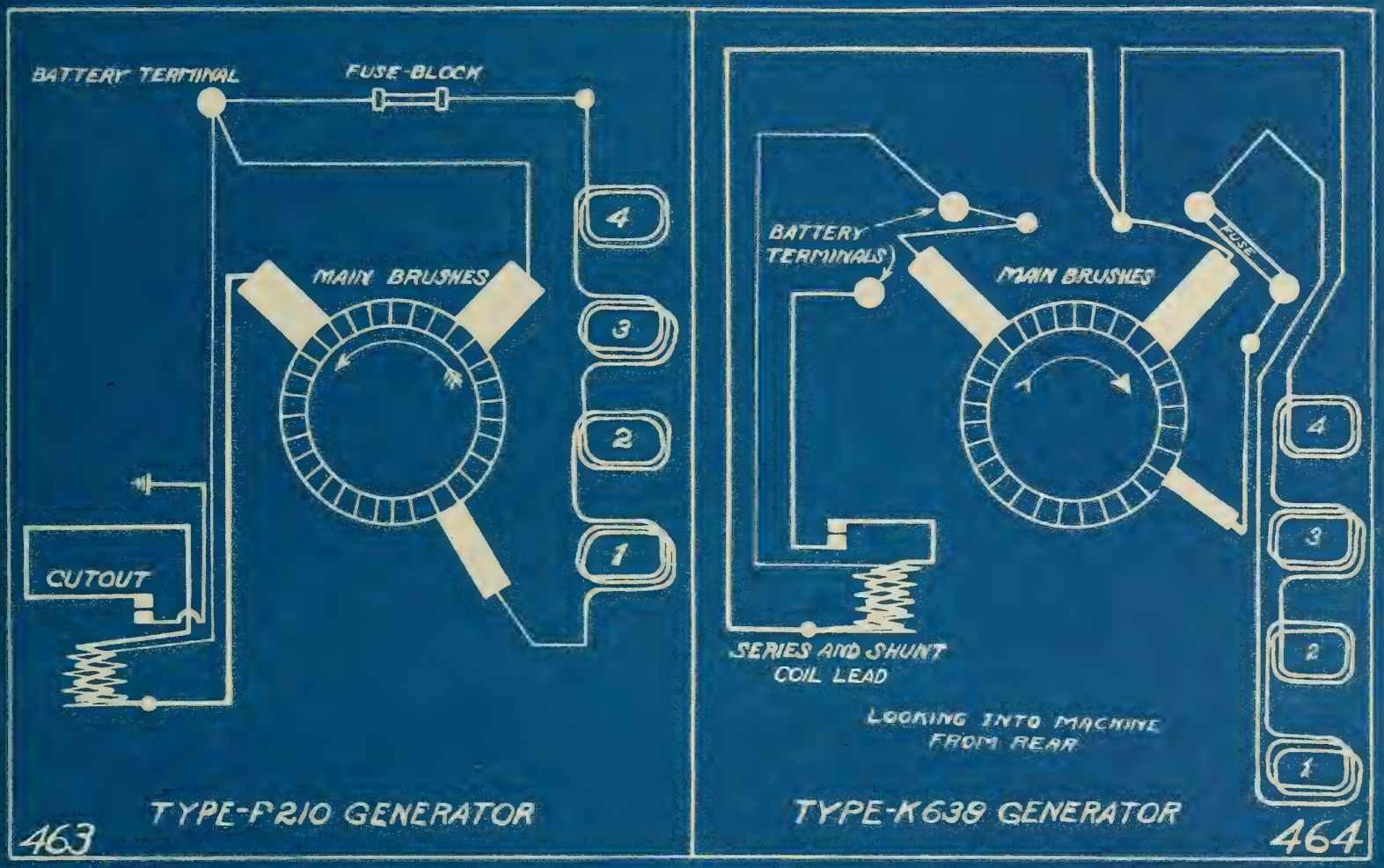
BIJUR FRONTHEAD TYPE L 61 GENERATOR

INTERNAL CIRCUITS GROUNDED SYSTEM.

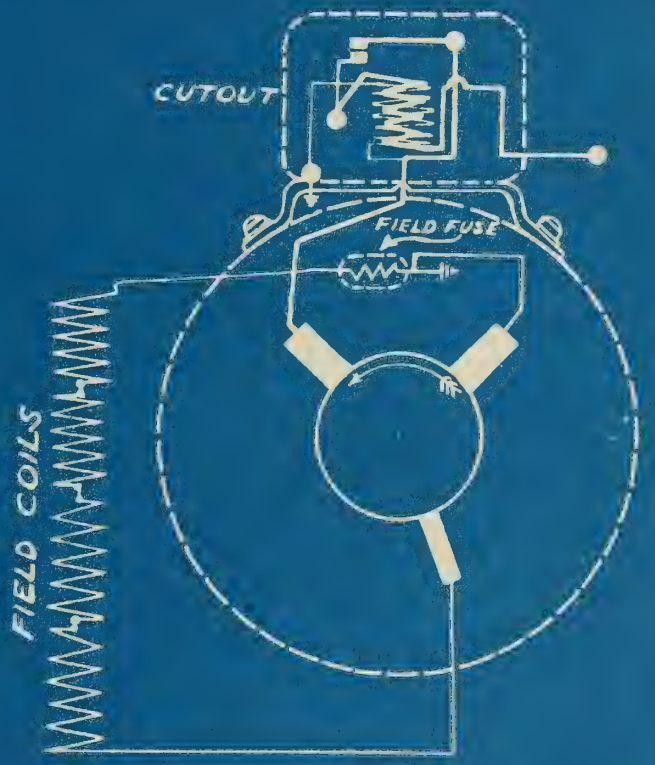


BIJUR INTERNAL CIRCUITS



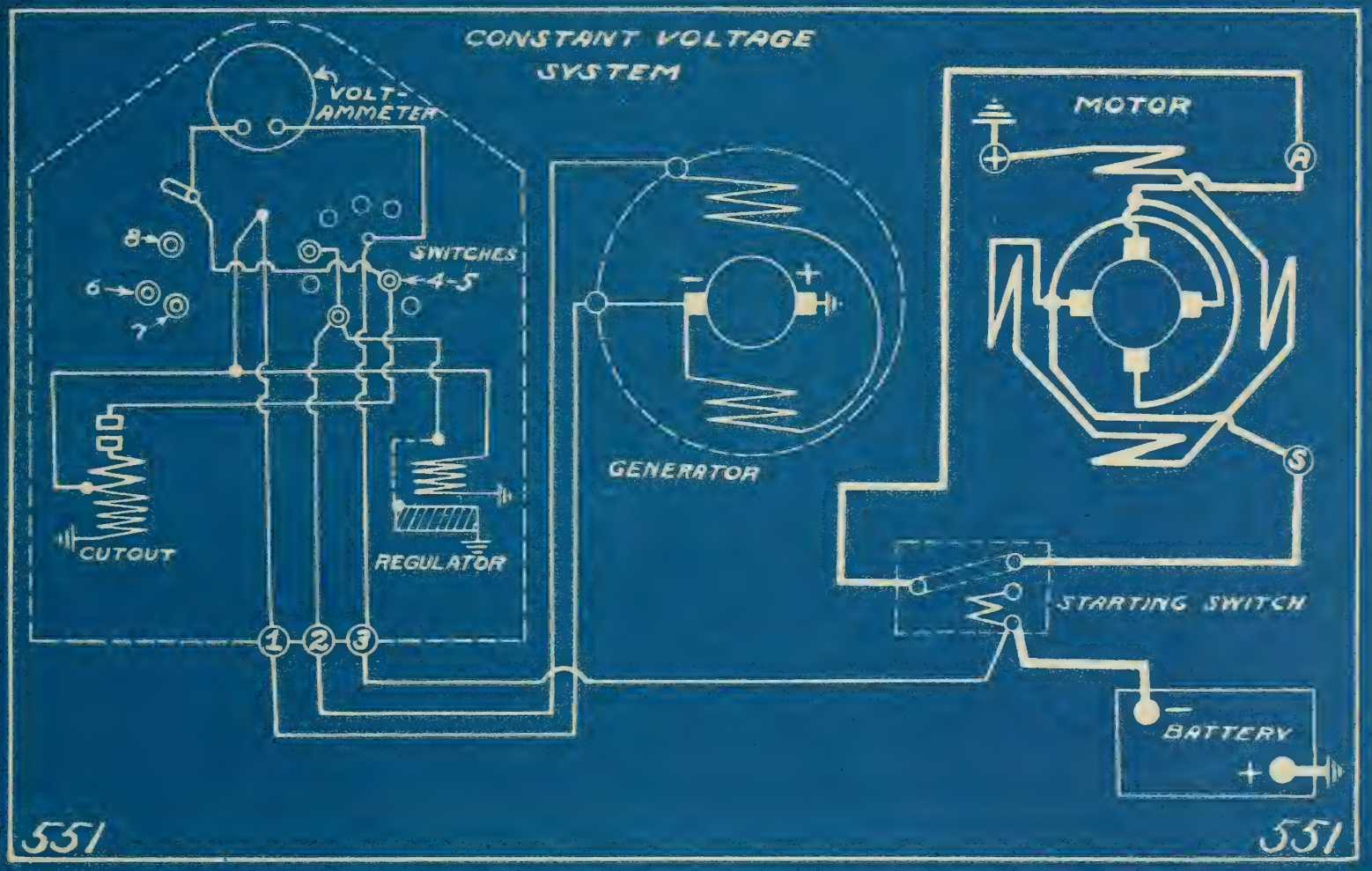
BIJUR INTERNAL CIRCUITS

465 TYPE H-66 GENERATOR

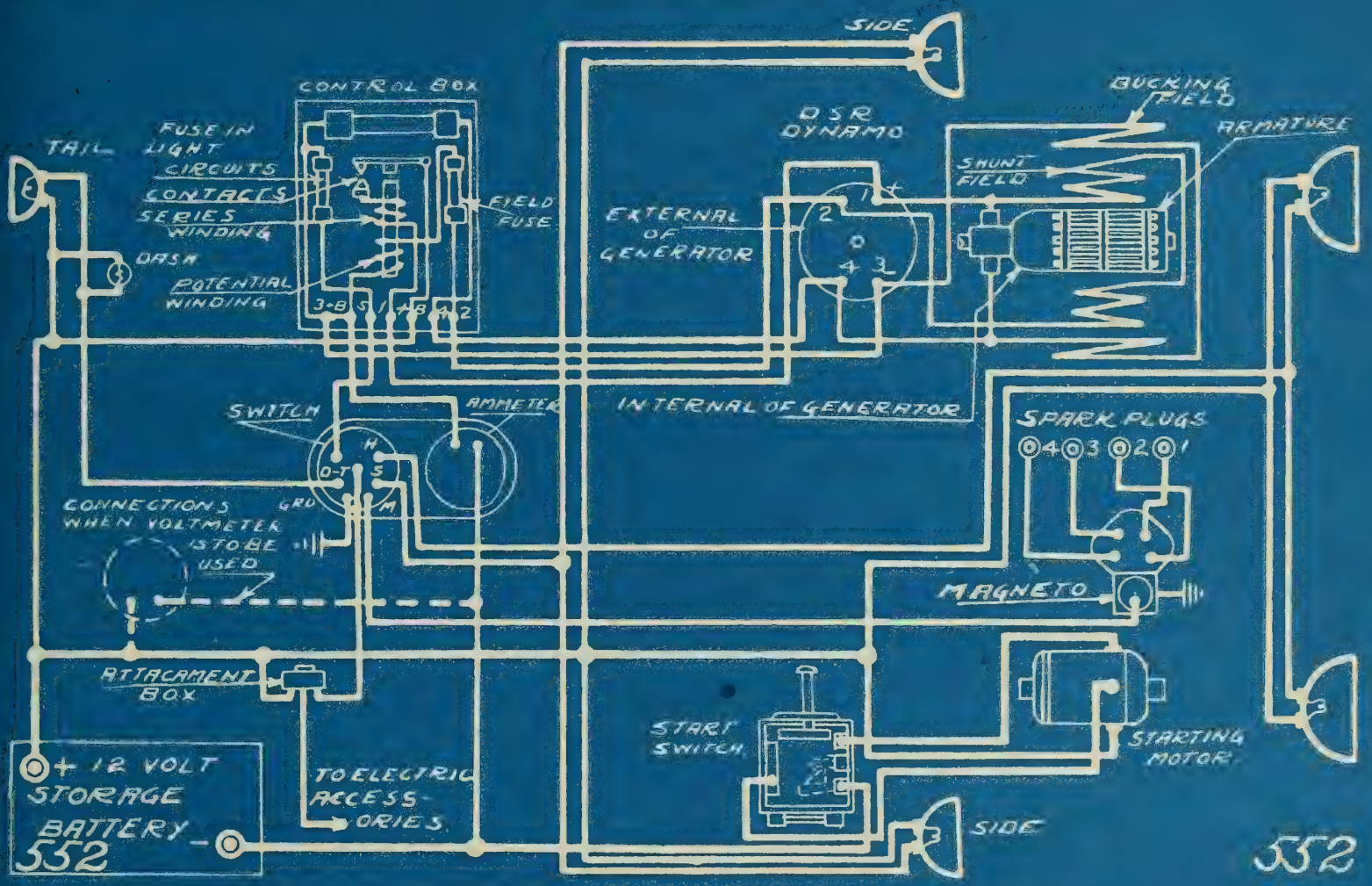


TYPES L-220 P-230 K-230 U-250 GEN. 466

BOSCH INTERNAL CIRCUITS



BOSCH STANDARD LIGHTING SYSTEM



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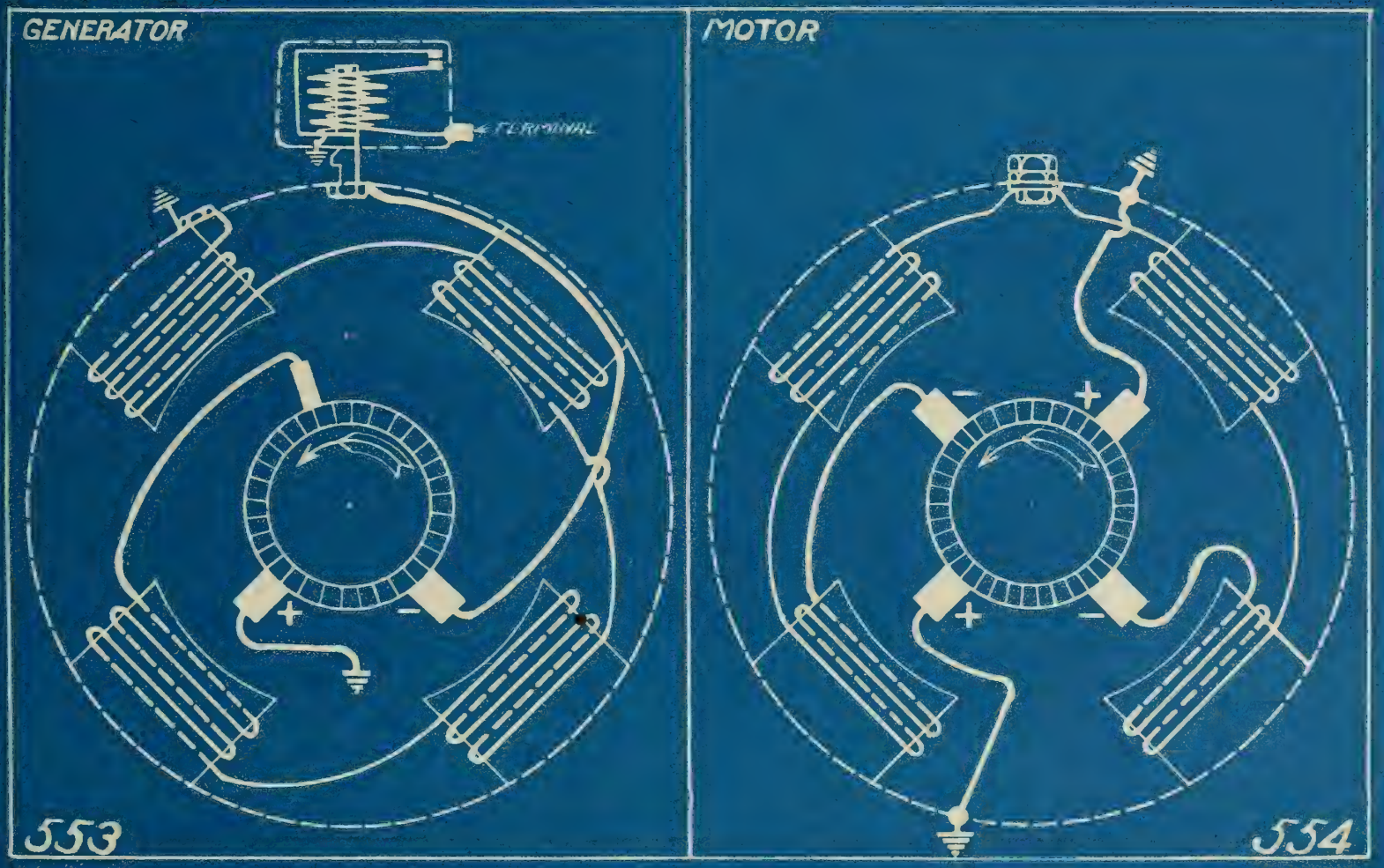
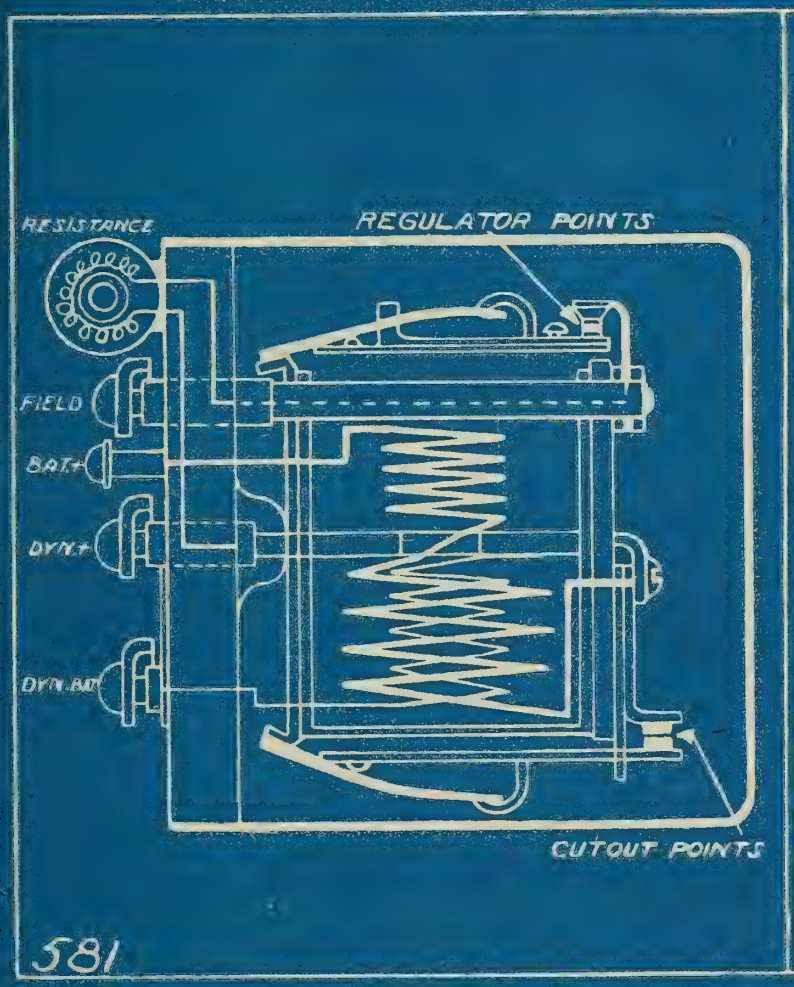
BOSCH INTERNAL CIRCUITS



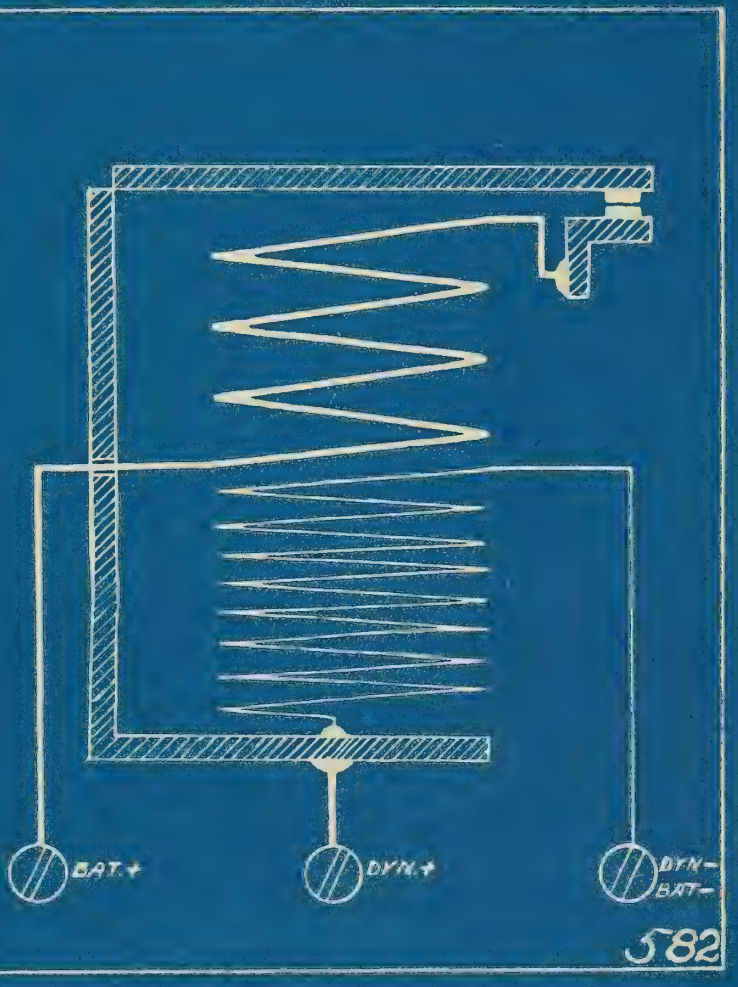
BRIGGS & STRATTON

REGULATOR & CUTOUT



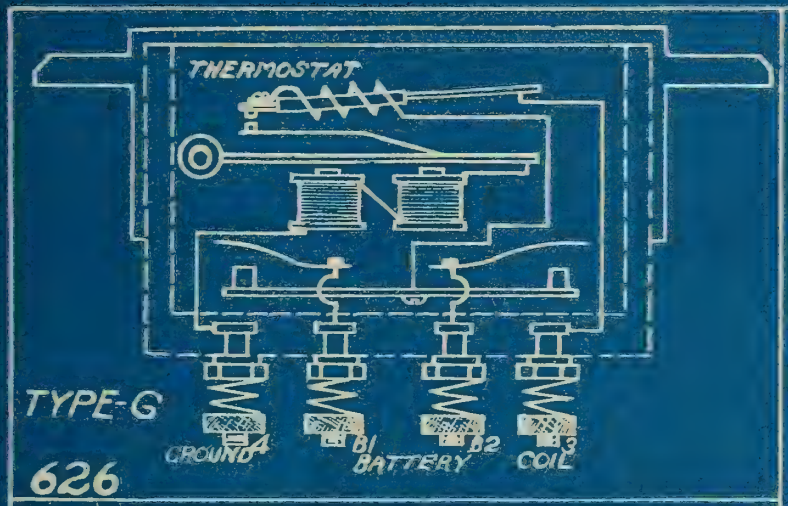
581

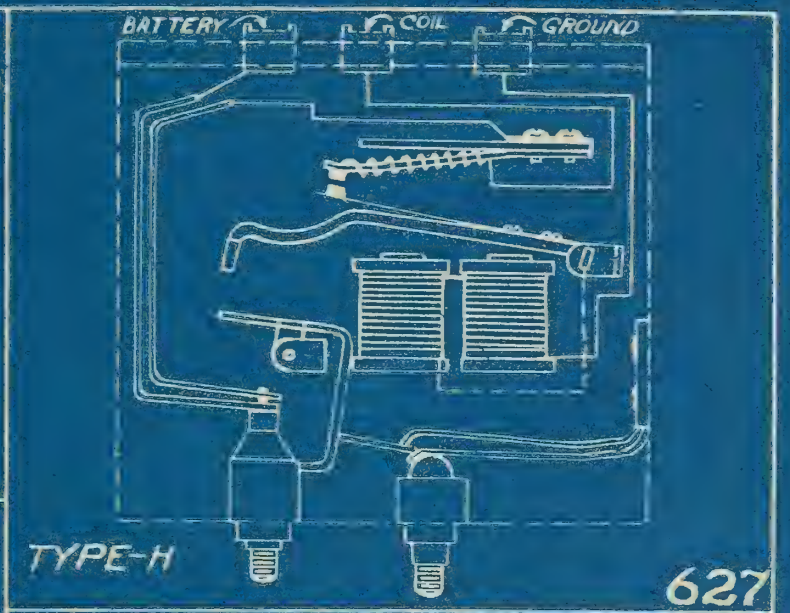
CUTOUT

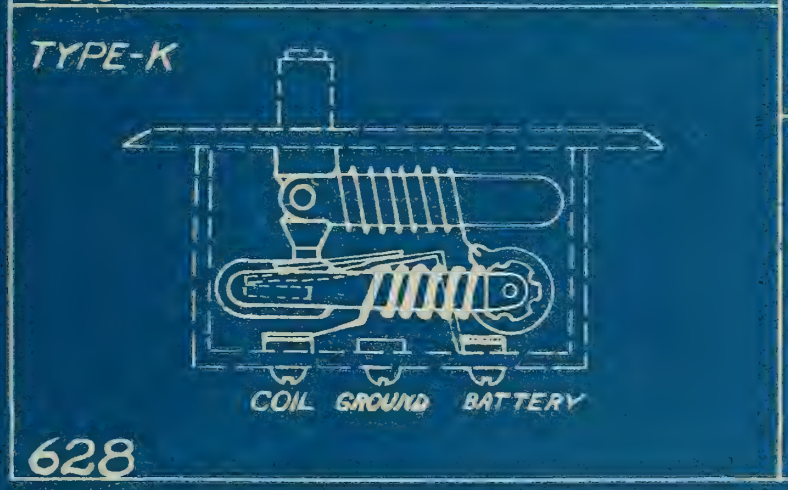


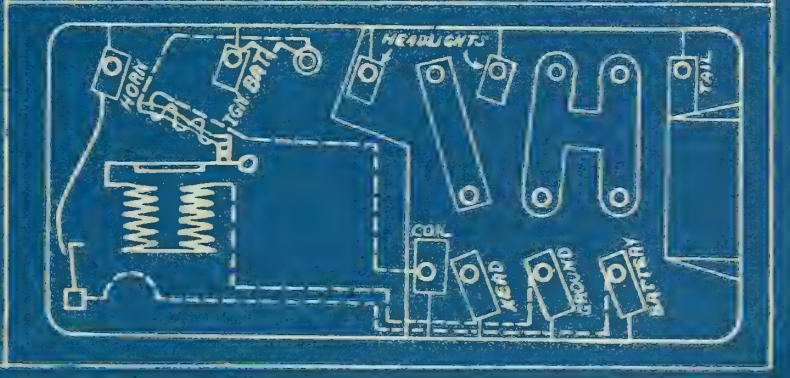
582

CONNECTICUT SWITCHES

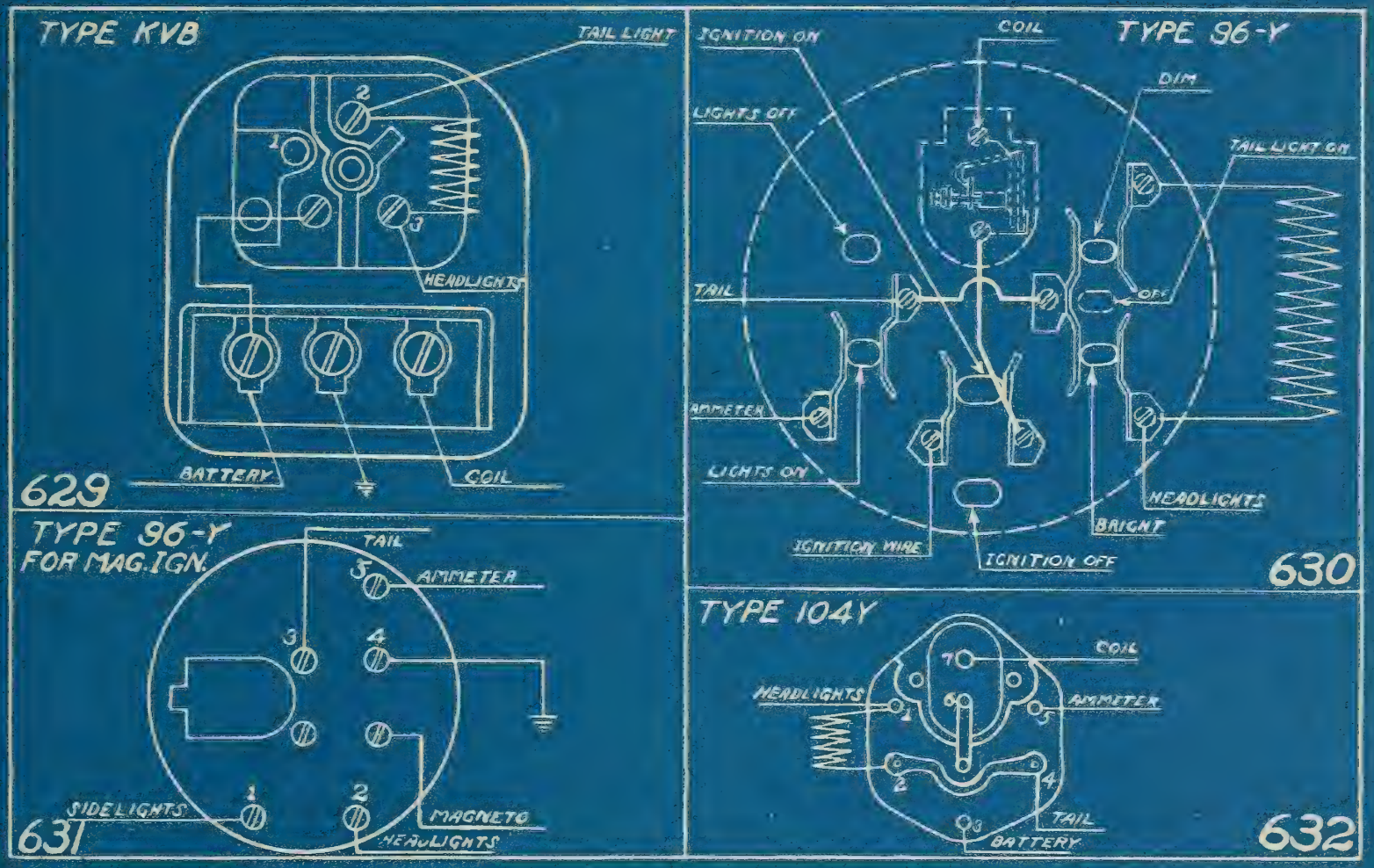




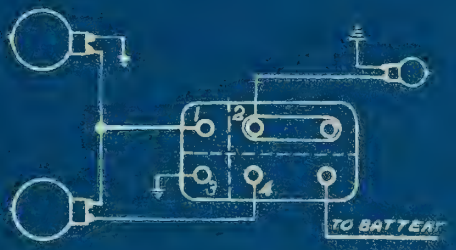




CONNECTICUT SWITCHES

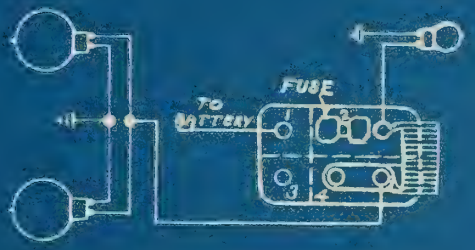


CONNECTICUT LIGHTING SWITCHES



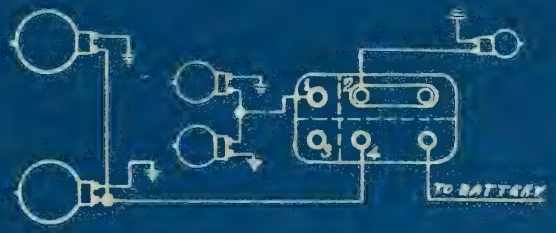
TYPE HND SERIES DIMMING

633



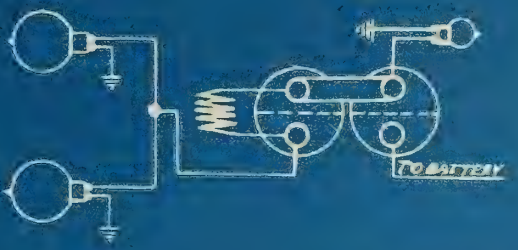
TYPE HND WITH RESISTANCE DIMMING

634



TYPE HND FOR DOUBLE BULB

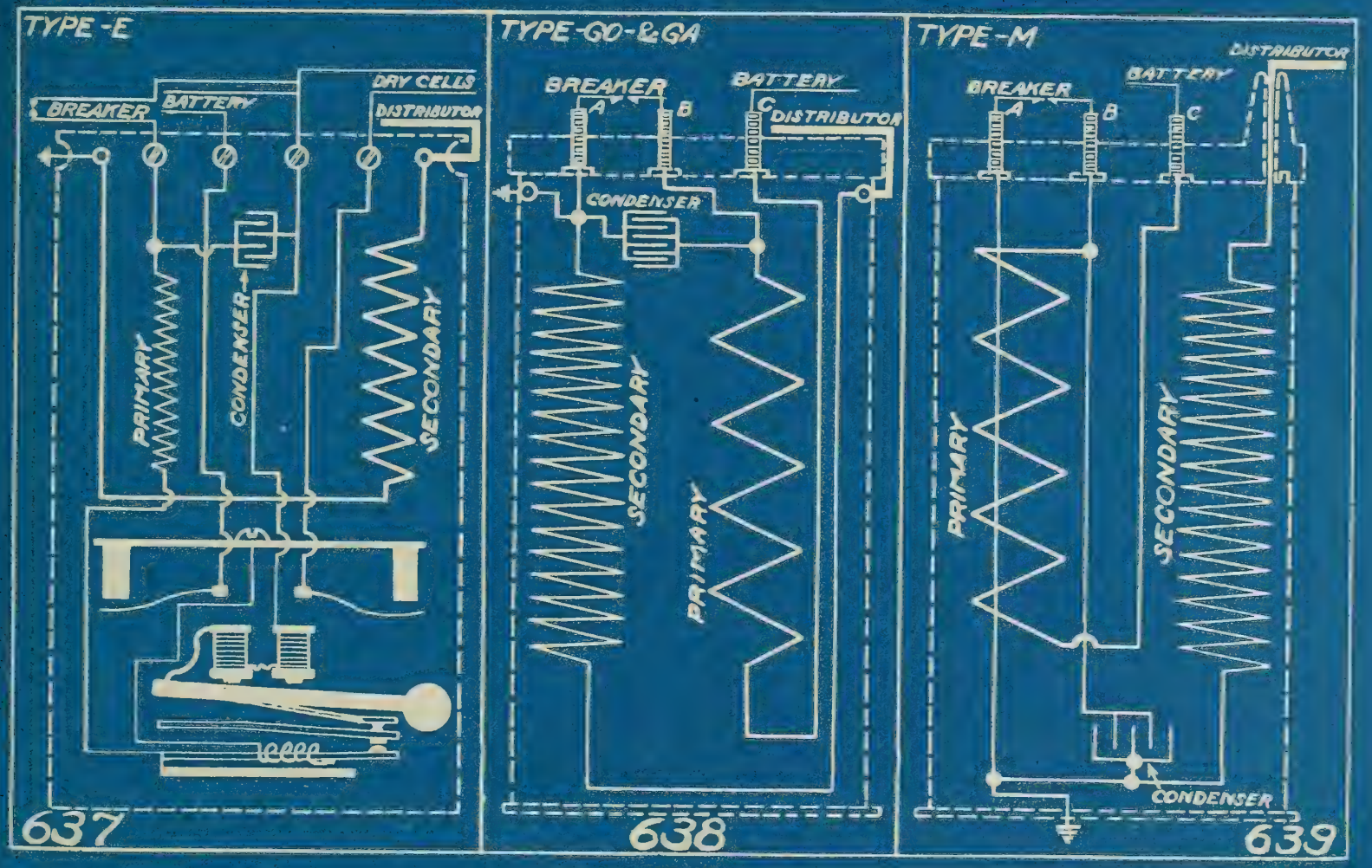
635



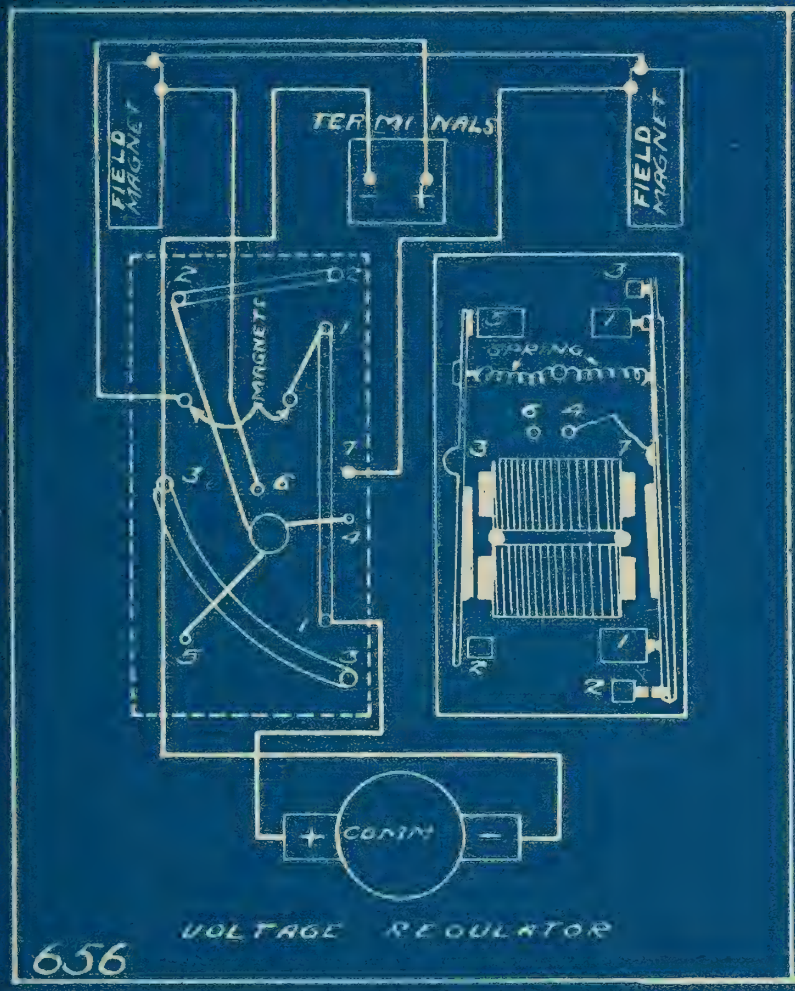
TYPE H-2NC WITH RESISTANCE DIMMING

636

CONNECTICUT COILS

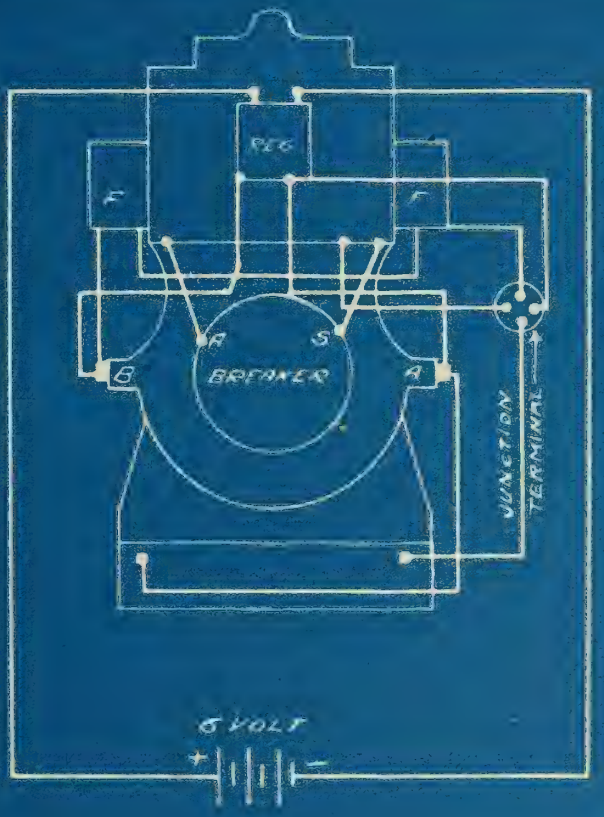


DEACO INTERNAL CIRCUITS



VOLTAGE REGULATOR

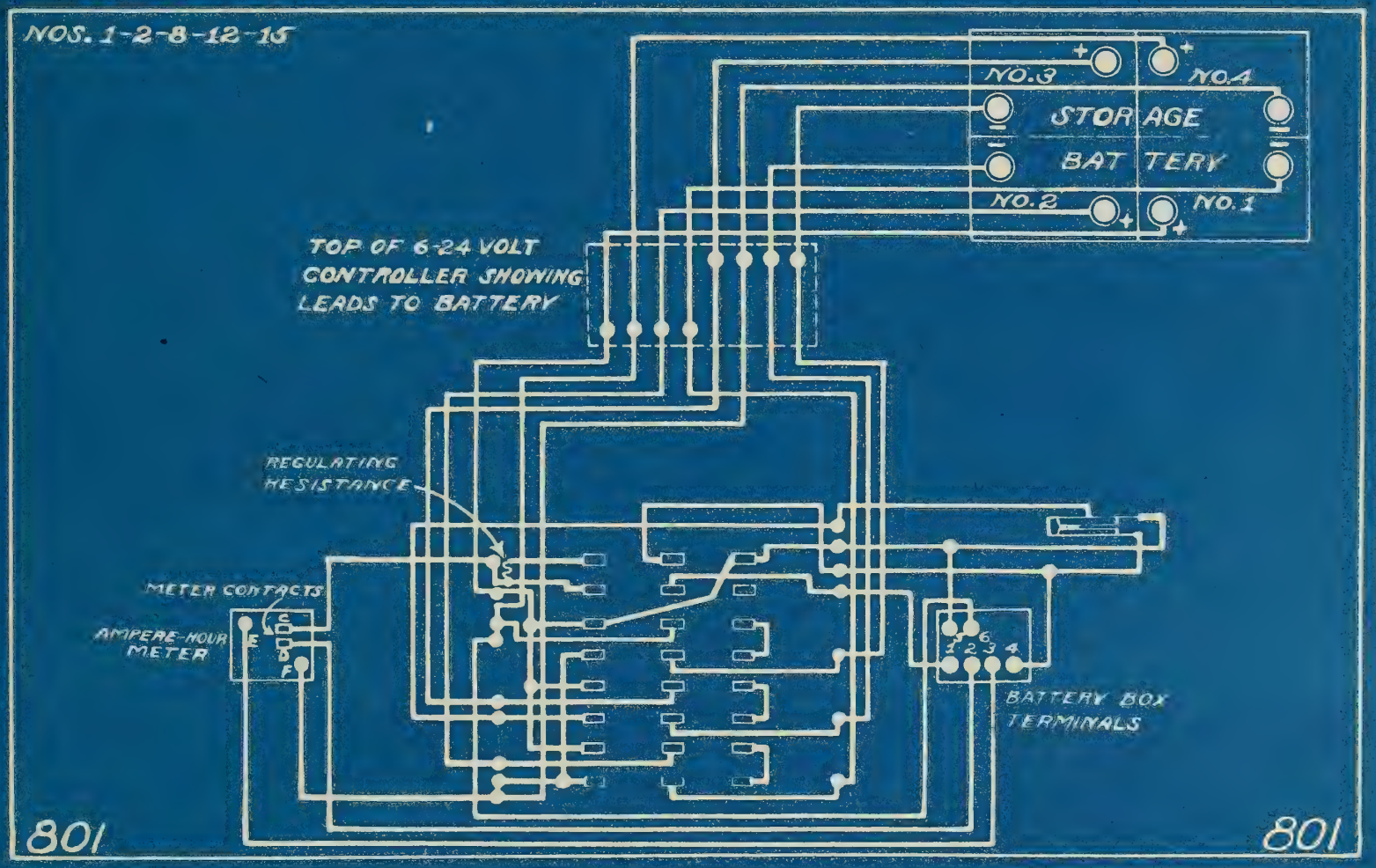
656



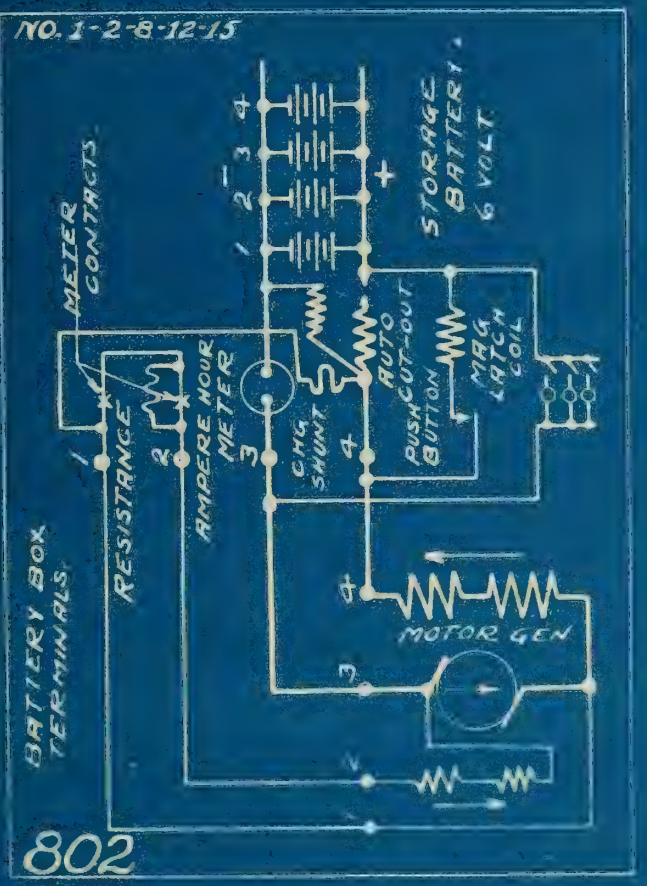
657

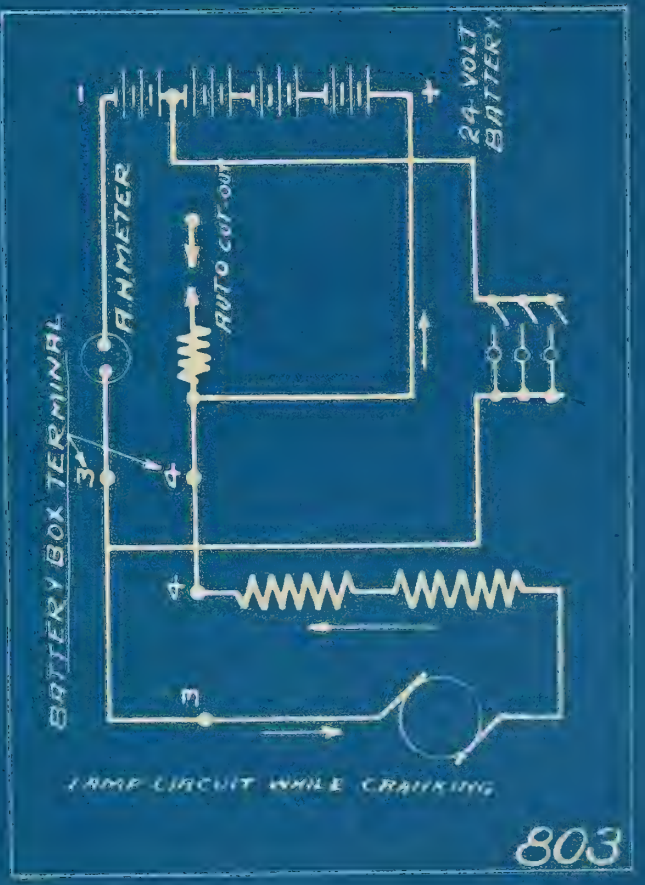
DELCO CONTROL SWITCH

6-24 VOLT SYSTEM

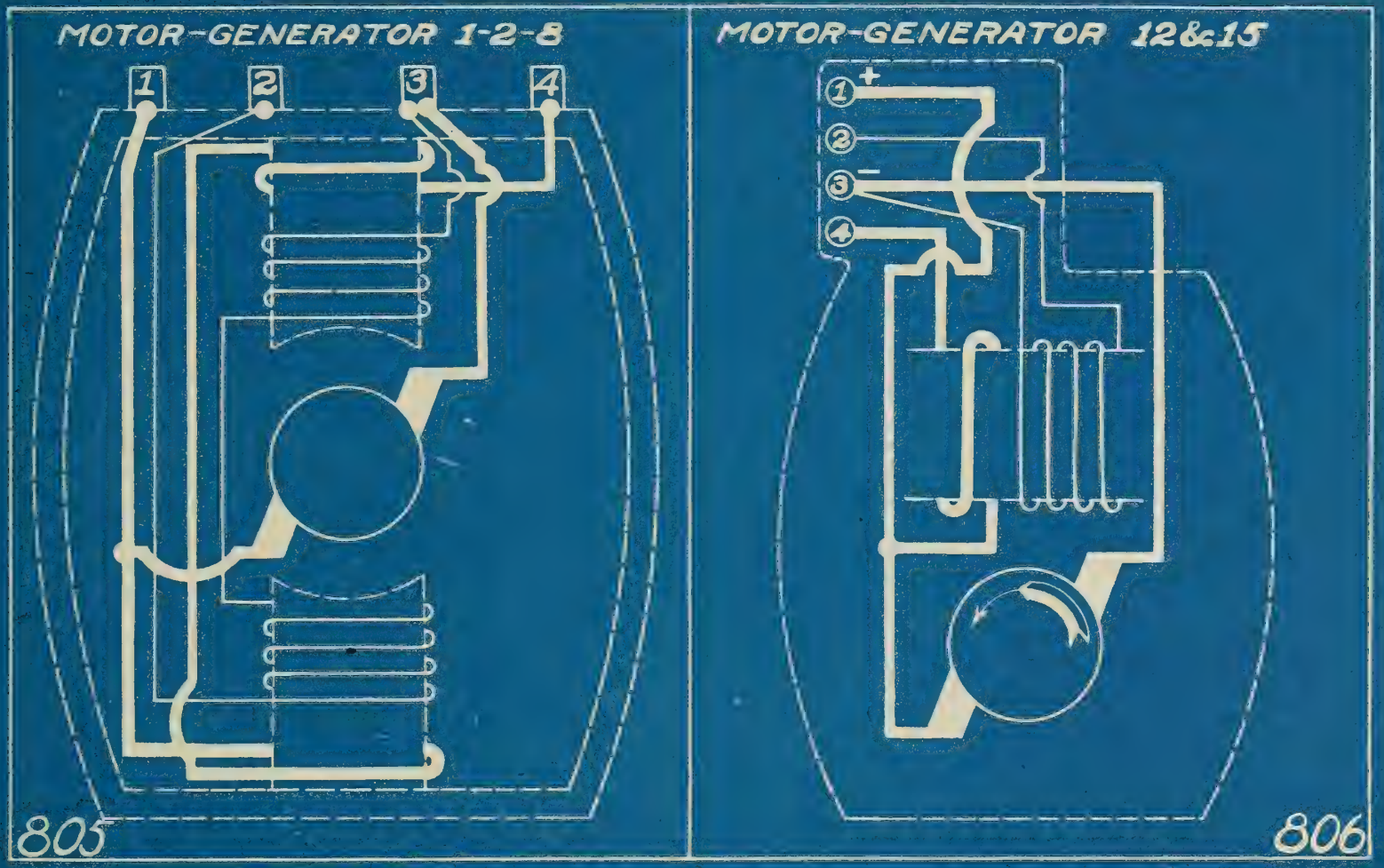


DELCO 1912-13 6-24 VOLT SYSTEM
INTERNAL MOTOR AND GENERATOR CONTROL

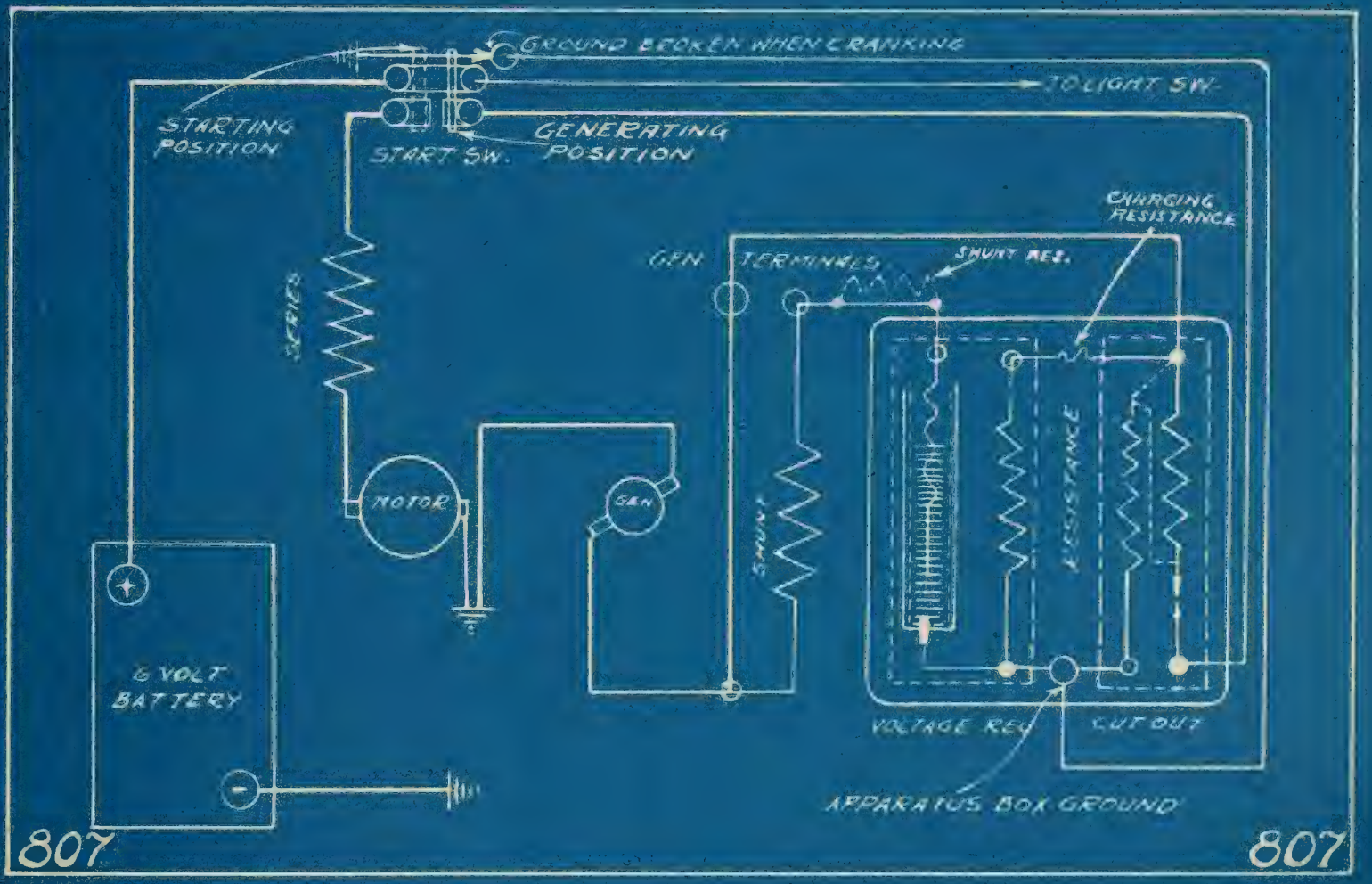




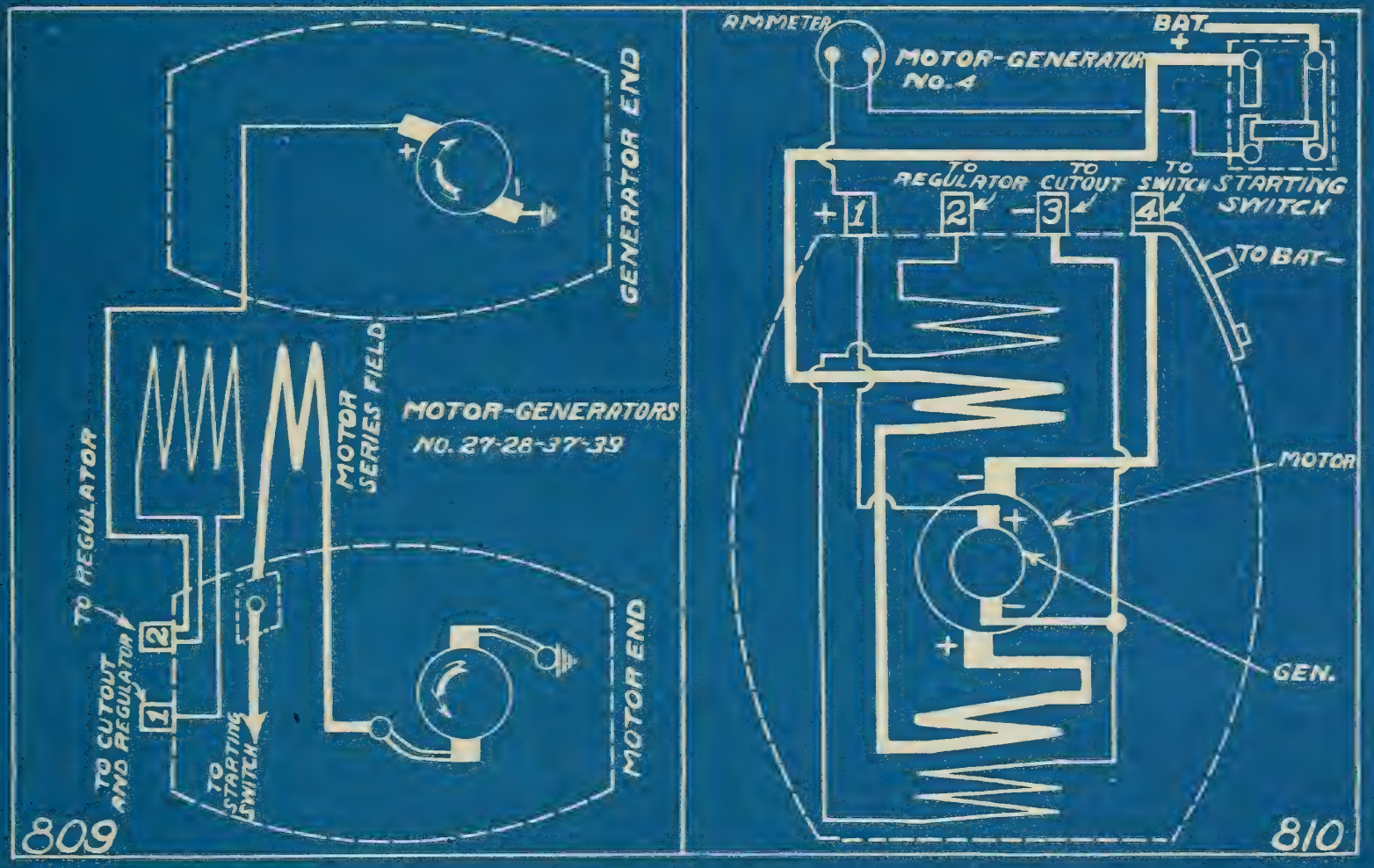
DELCO INTERNAL CIRCUITS



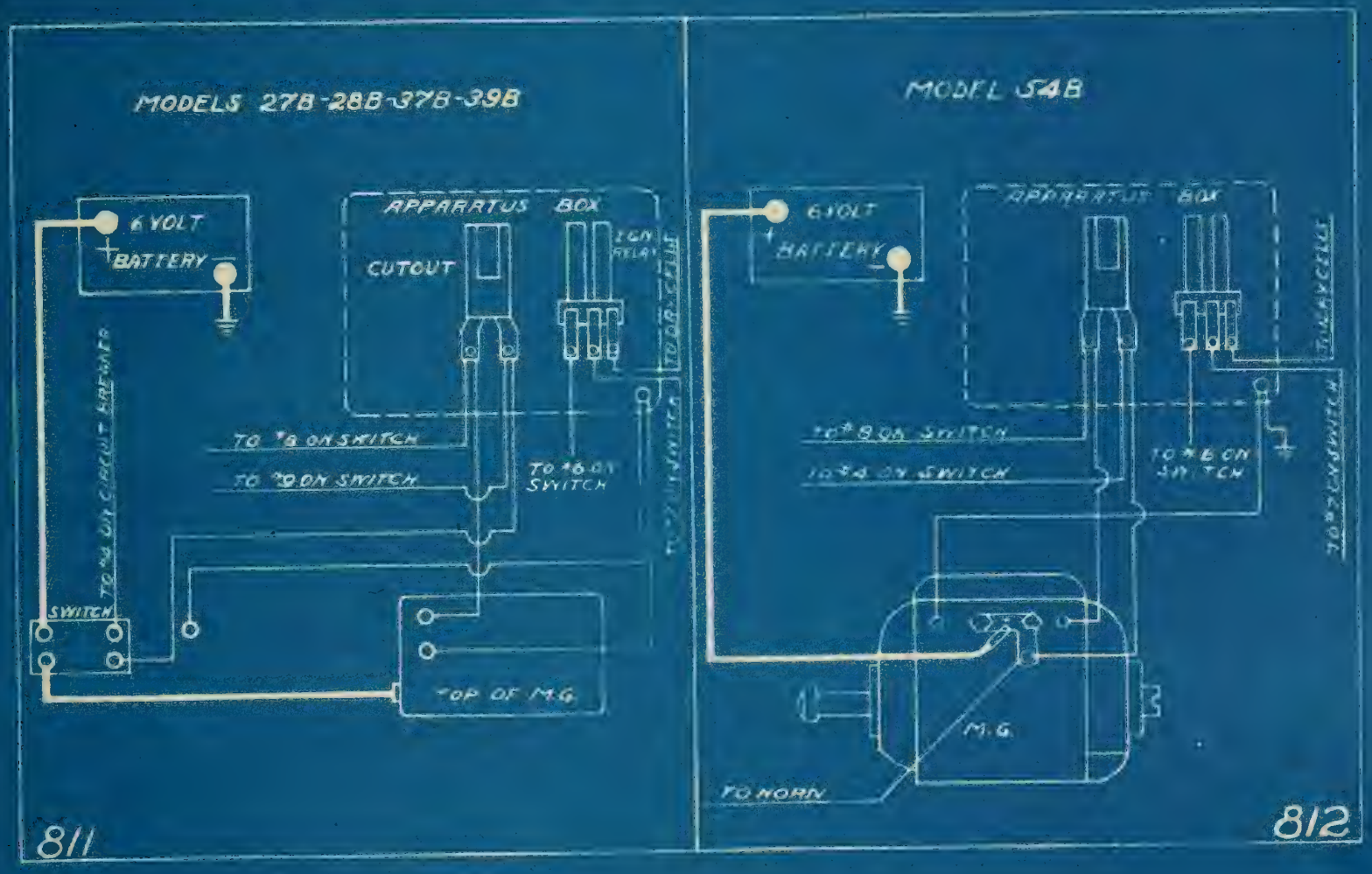
DELCO VOLTAGE REGULATOR
INTERNAL CIRCUITS



DELCO INTERNAL CIRCUITS

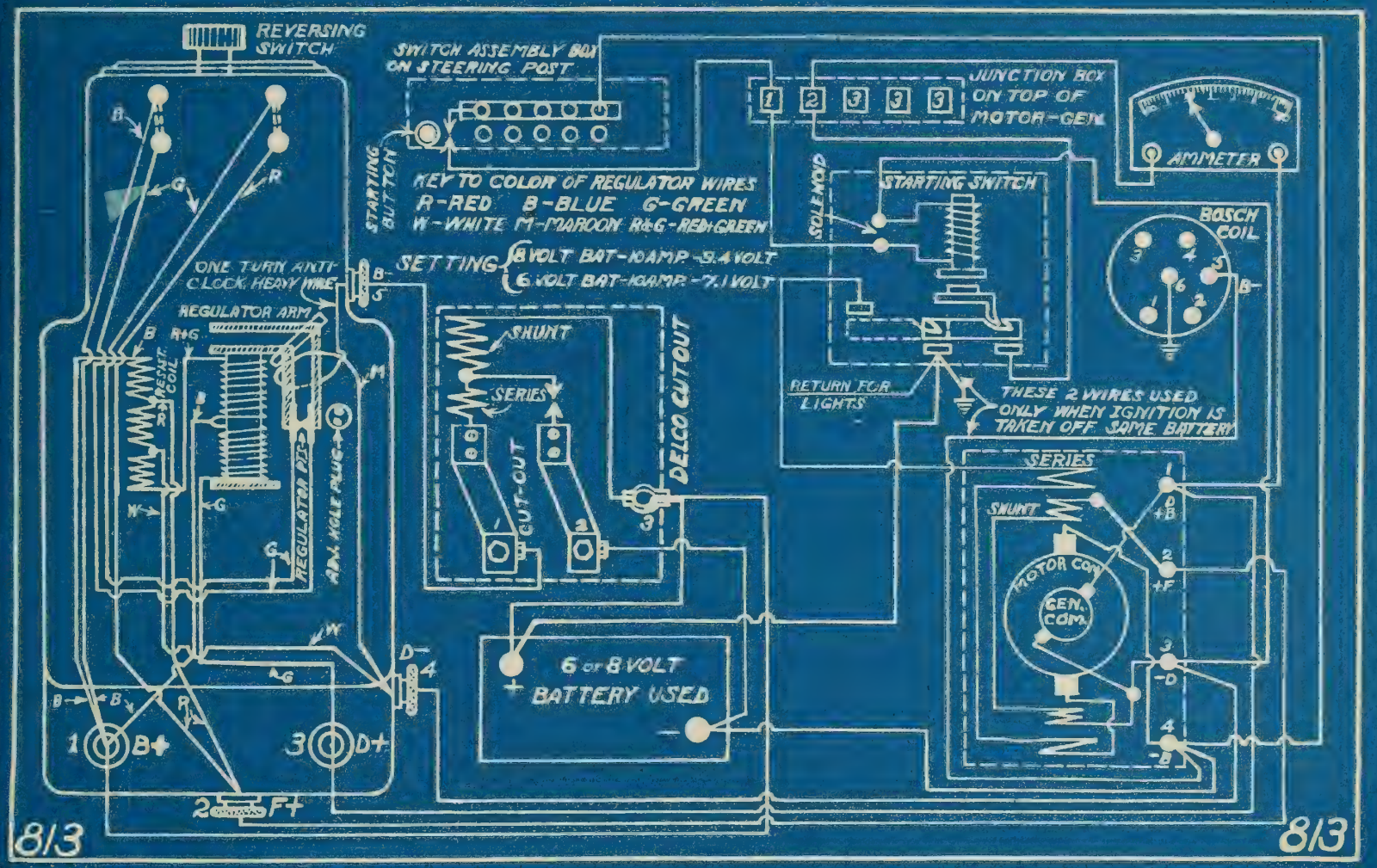


DELCO REBUILT MOTOR-GENERATORS



DELCO MOTOR-GENERATOR WITH BIJUR REGULATOR

USED ON 1914 "1-38" & "3-48" PACKARD CARS



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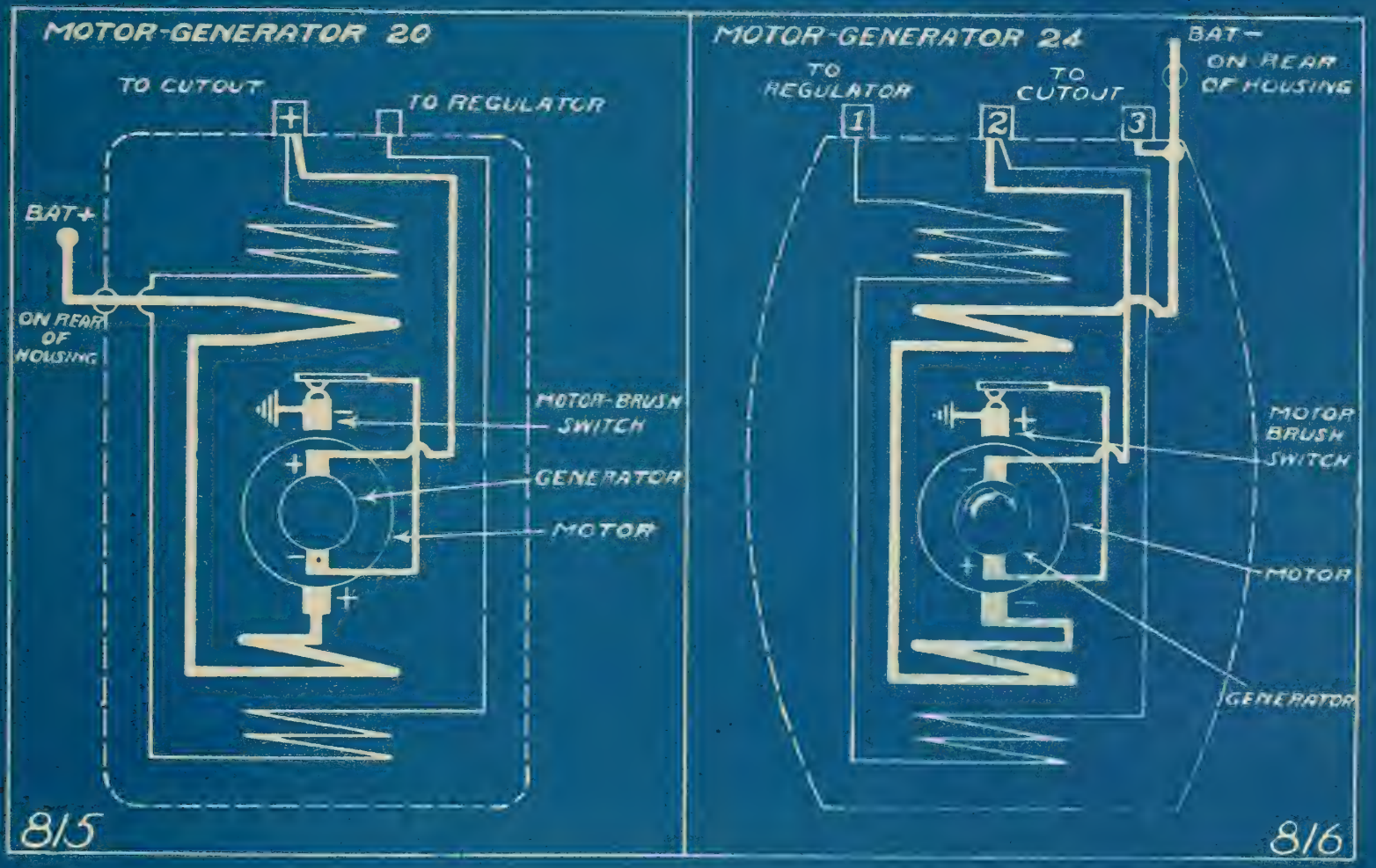

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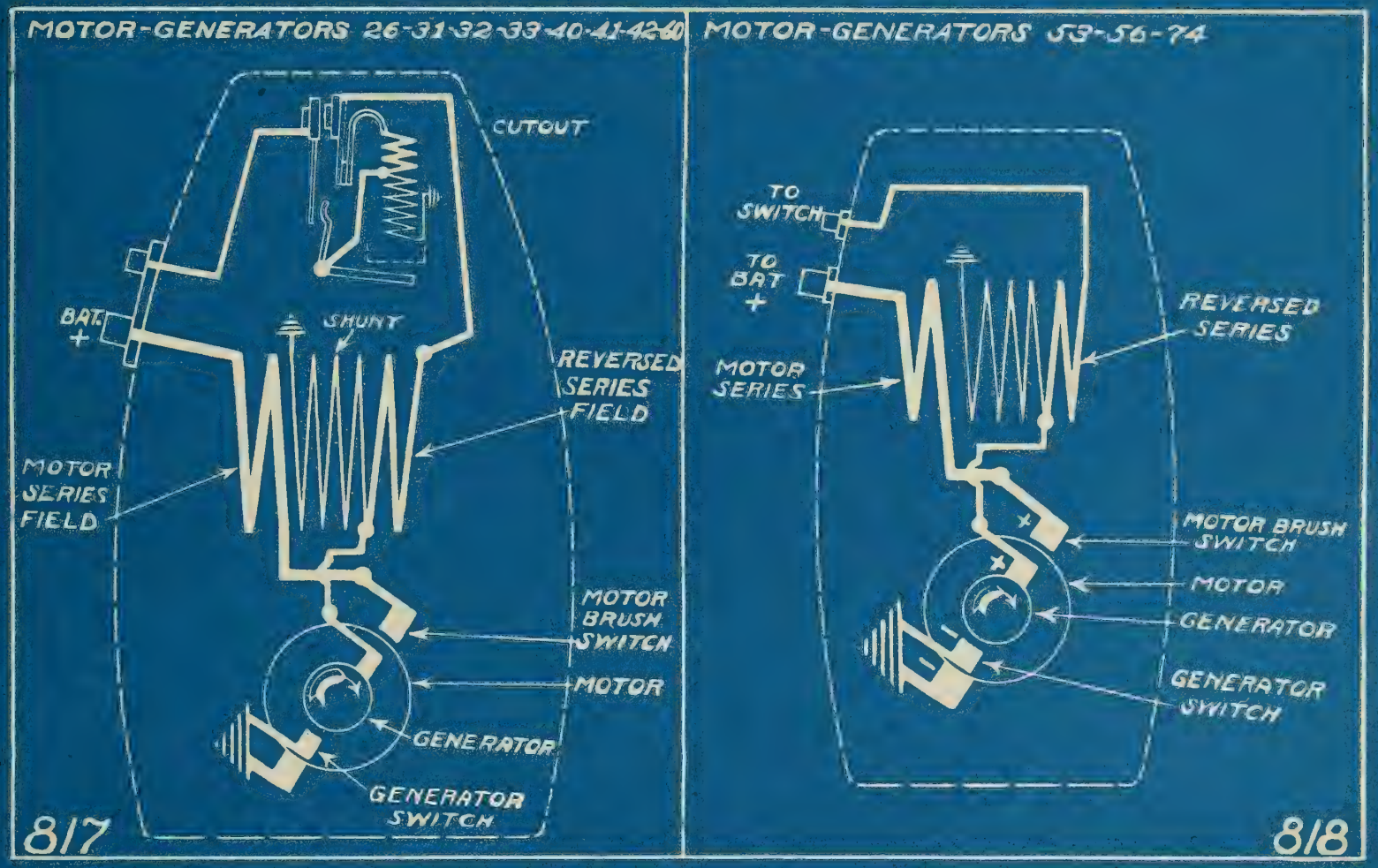
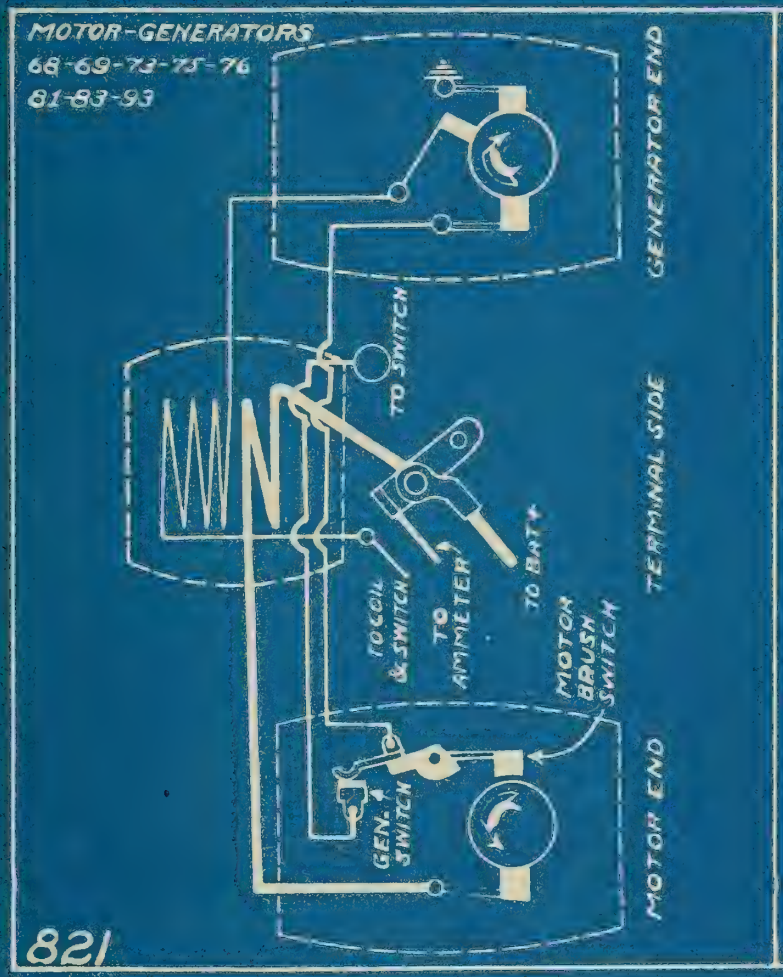
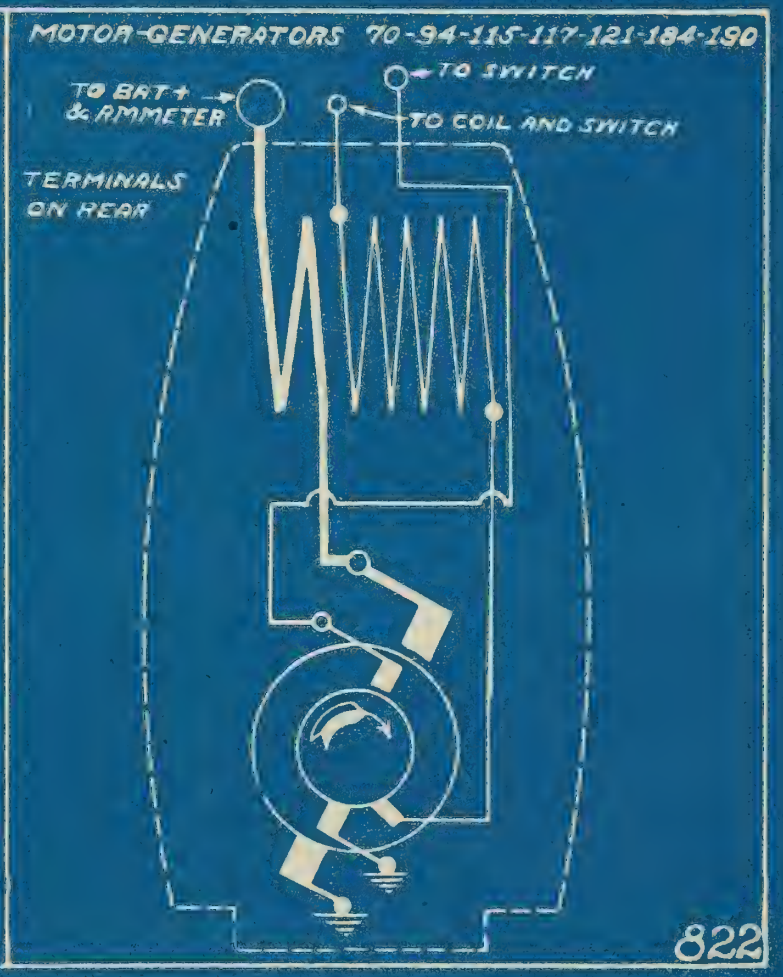


DELCO INTERNAL CIRCUITS

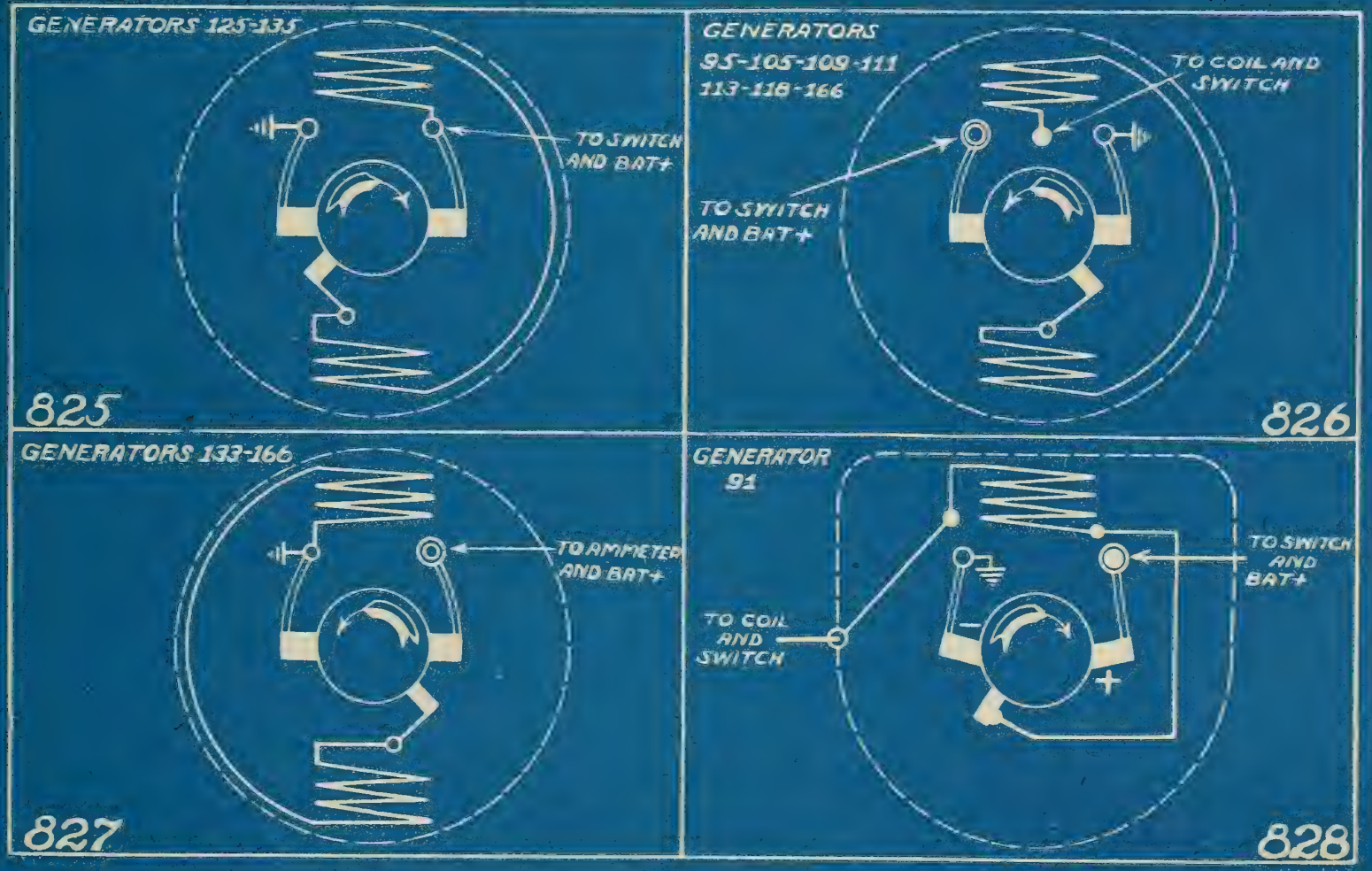
DELCO INTERNAL CIRCUITS





DELCO INTERNAL CIRCUITS

DELCO INTERNAL CIRCUITS



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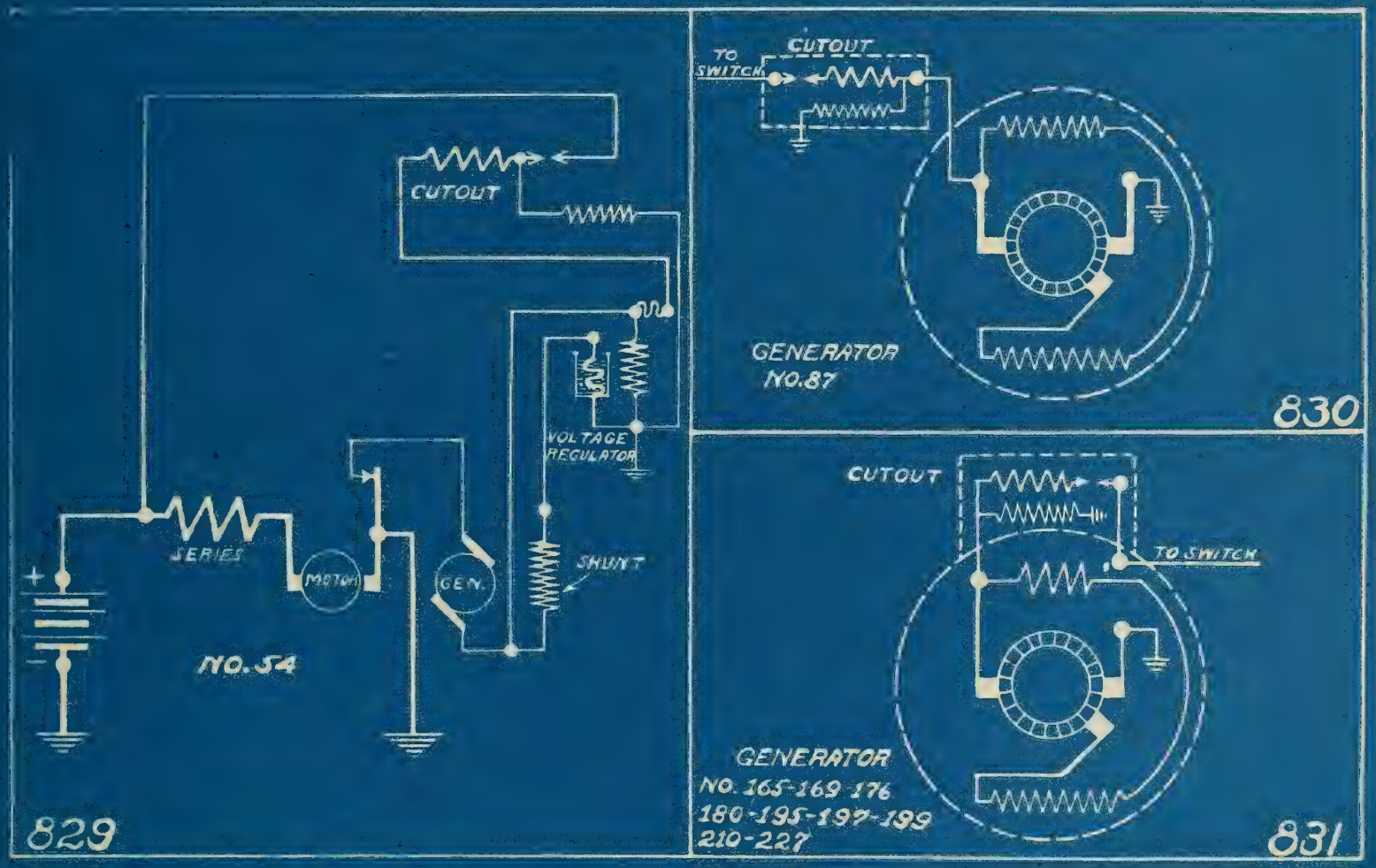

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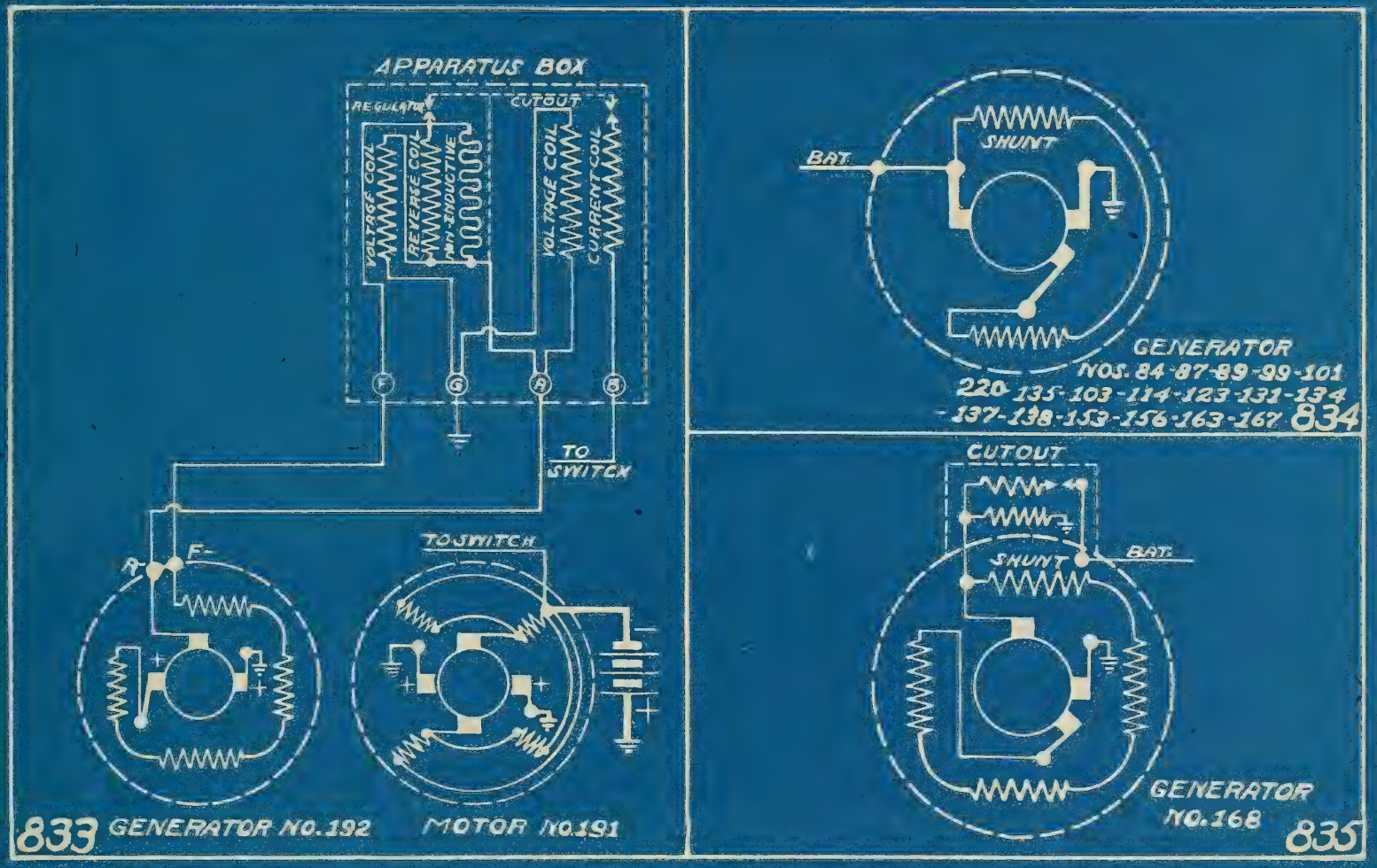

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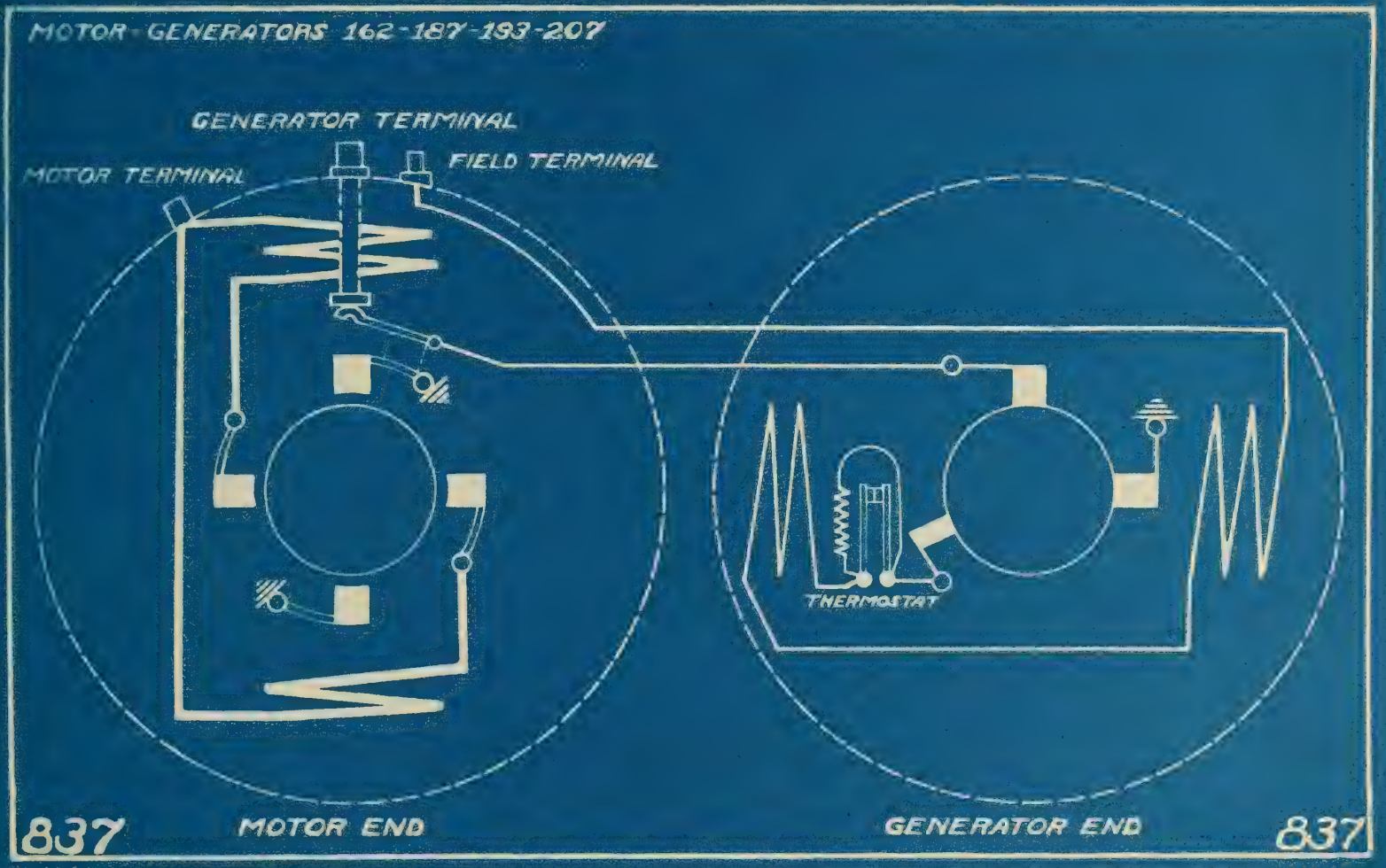


DELCO SWITCHES

MODELS
1033-1035-1042

871

MODEL 1045

872

MODELS
1062-1069-1077
1099-1150

873

MODEL 1079

874

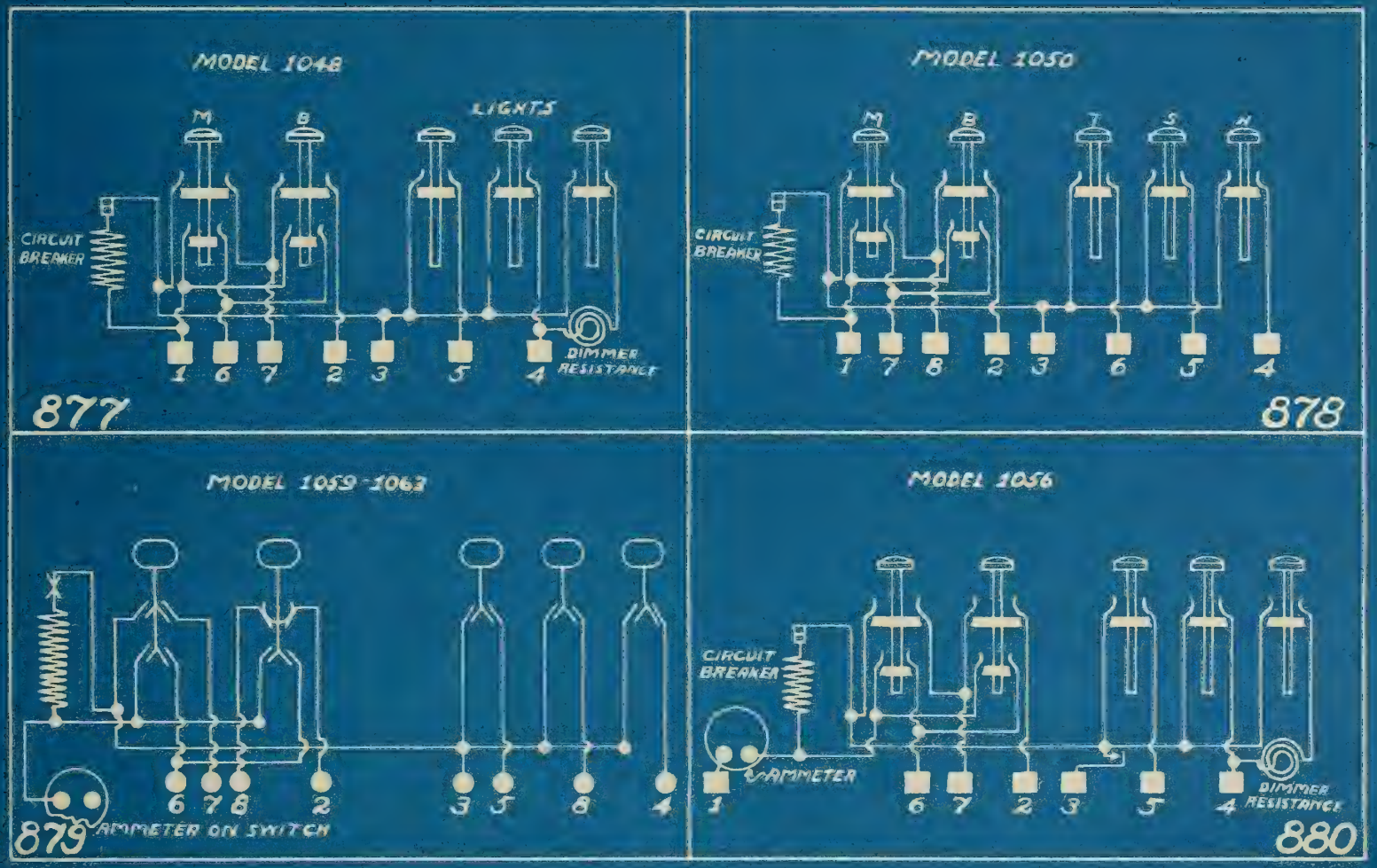
MODELS
1082-1093
1132-1142-1154-1155

875

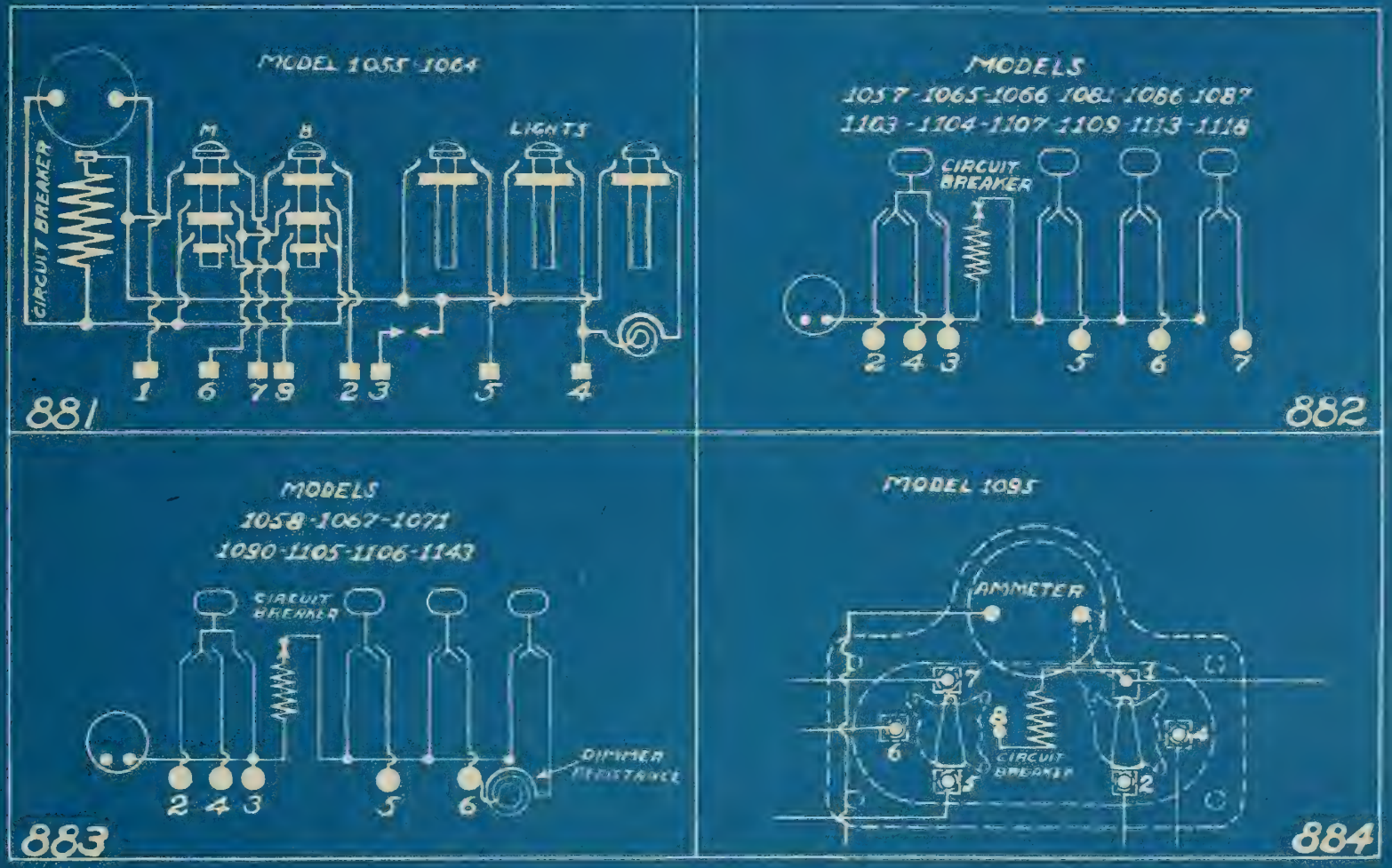
MODEL 1085

876

DELCO SWITCHES



DELCO SWITCHES

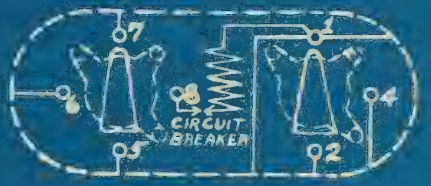


DELCO SWITCHES

MODEL 1040

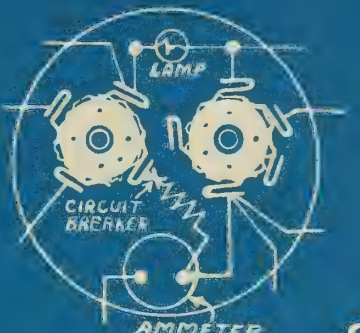
885

MODEL 1075-1078



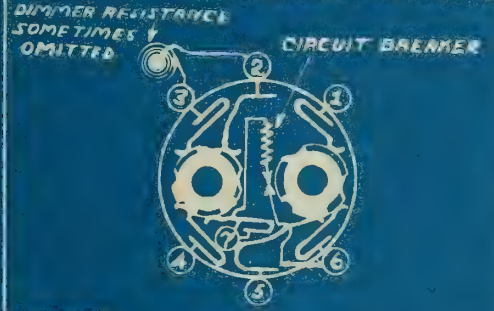
886

MODEL 1126



887

MODELS
1130-1133-1145-1146-1147-1149
1152-1158-1160-1164-1166-1171
1172-1174-1176-1177-1182-1189



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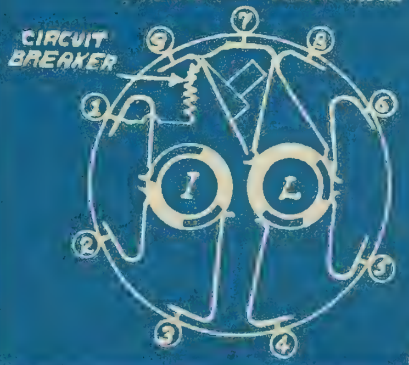
MODEL 1153

889

MODELS
1159-1188-1196-1197
1198-1199-1204-1211



890

DELCO SWITCHES

MODELS
1157-1161-1167-1173
1178-1180-1181-1184

891

MODEL 1163

892

MODELS 1183-1187

NO. 9 ON 1187 ONLY

893

MODEL 1185

894

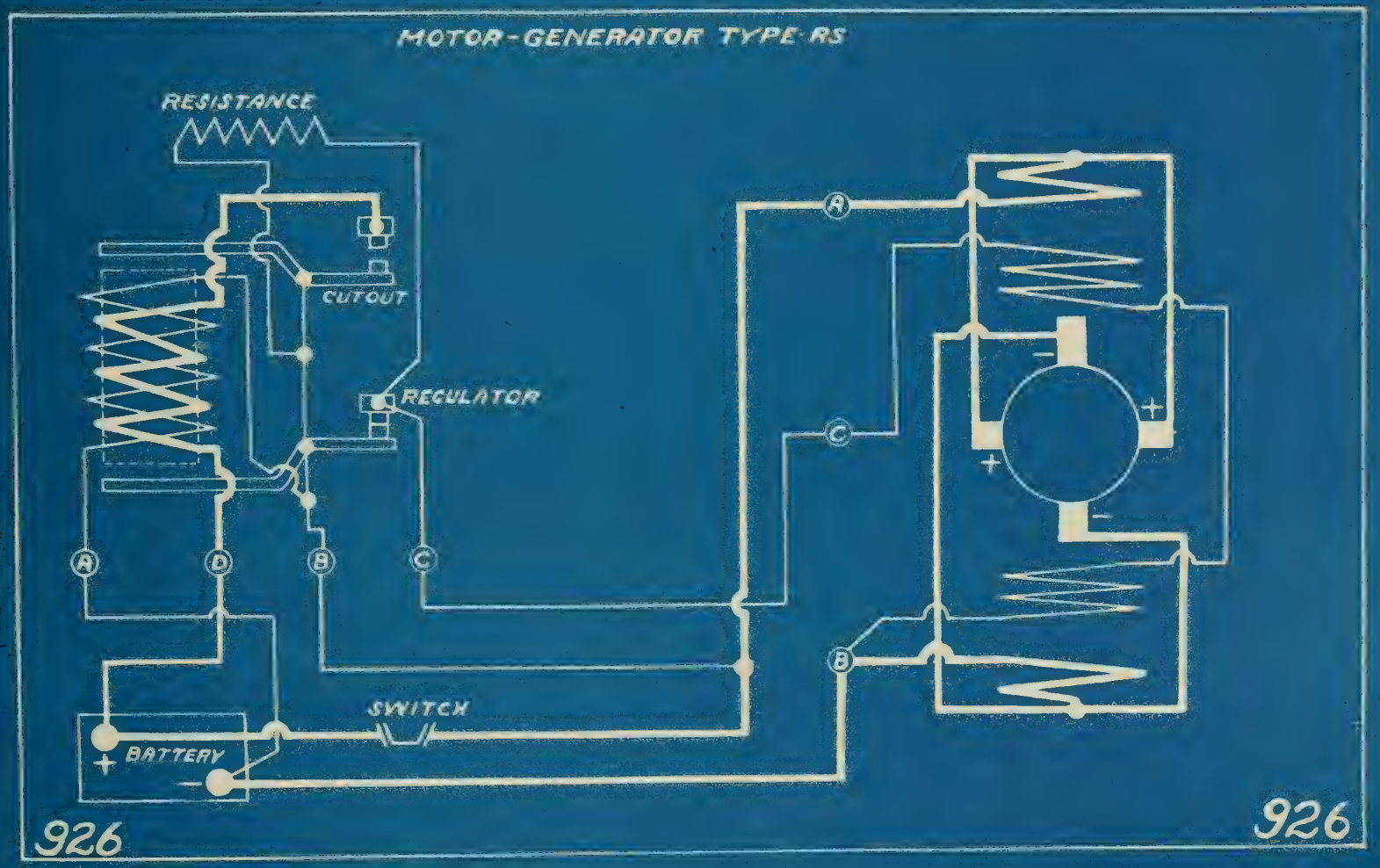
MODEL 1194

895

MODEL 1203

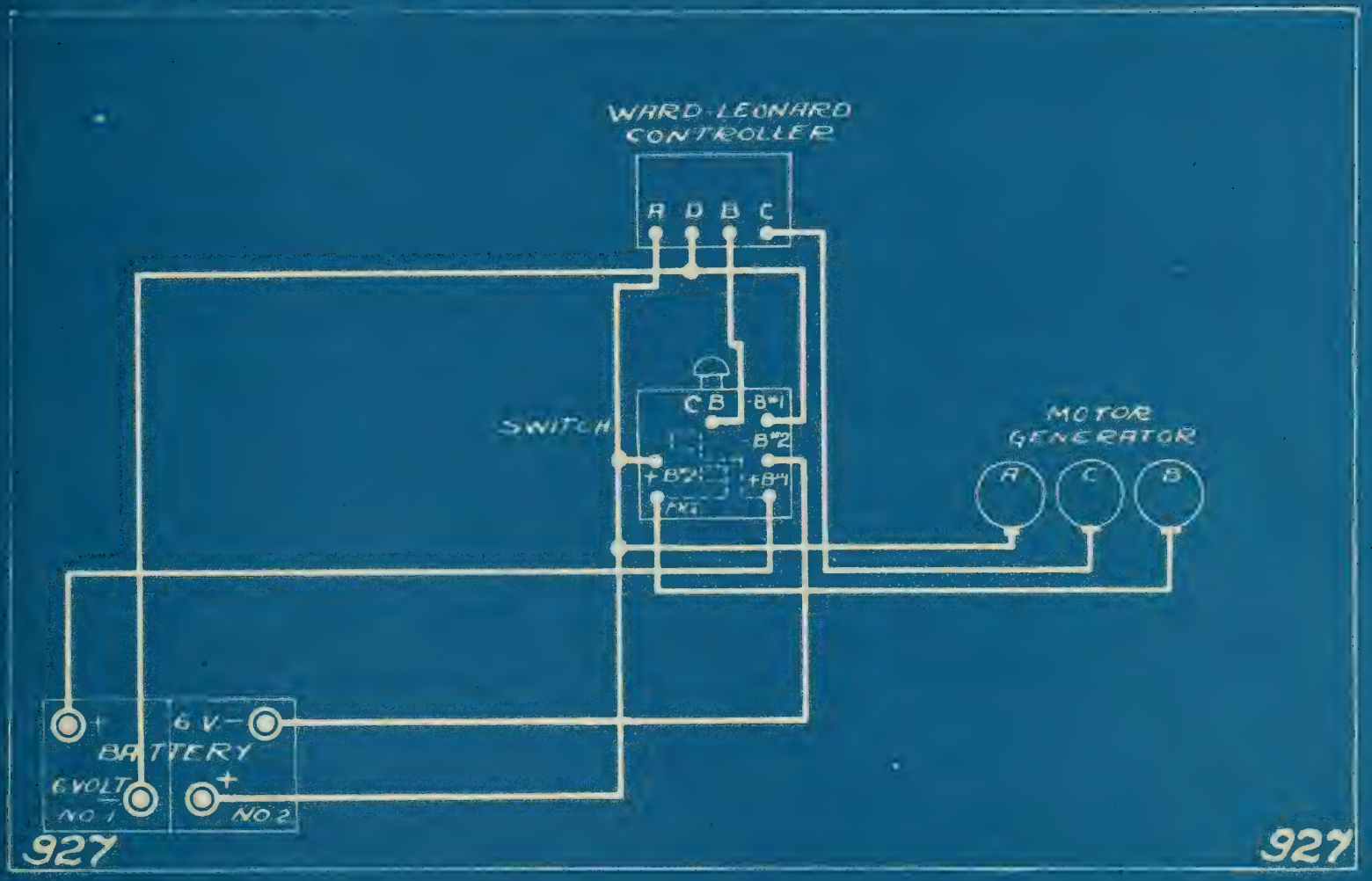
896

DETROIT WARD LEONARD

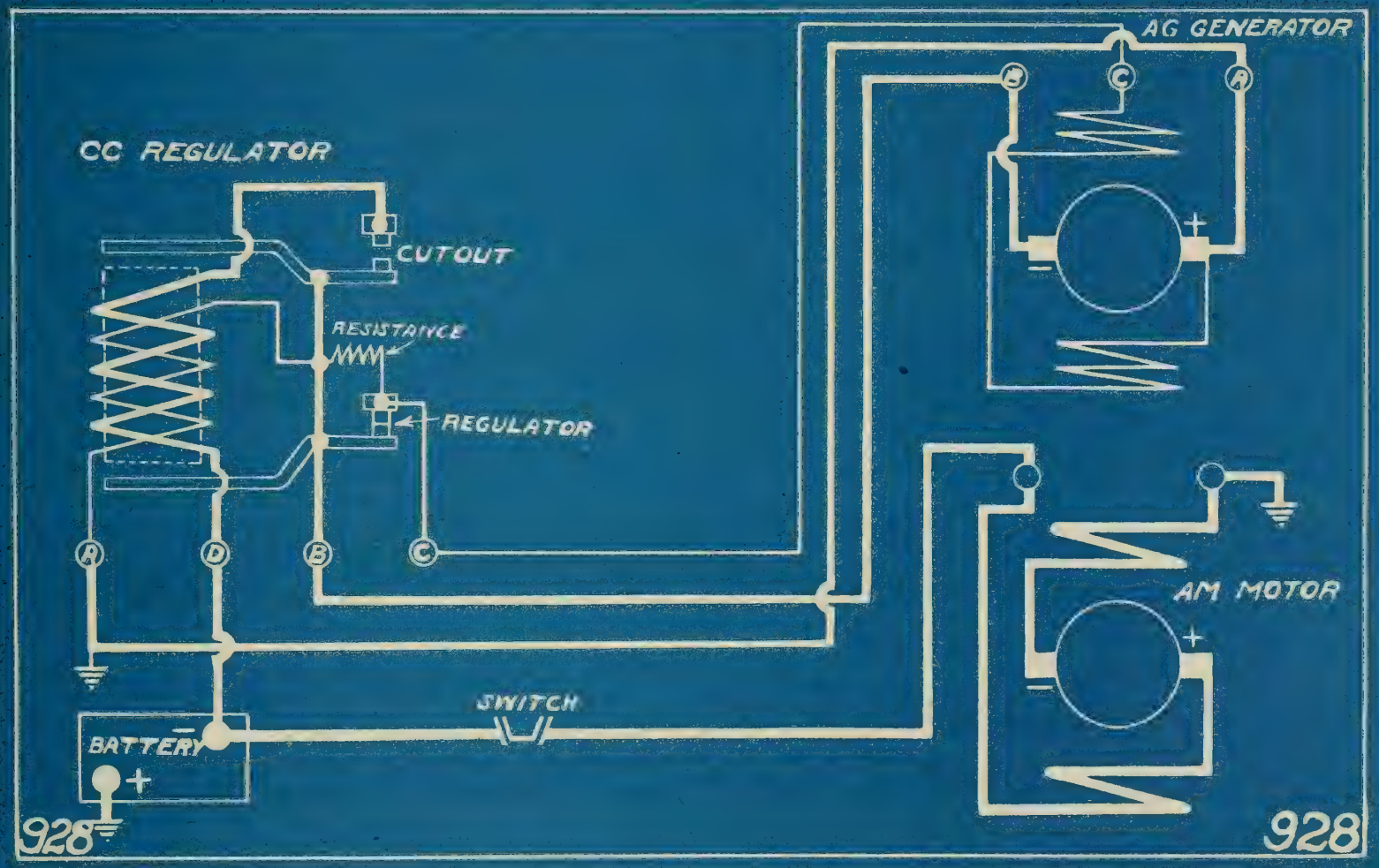


DETROIT R-S MOTOR-GENERATOR

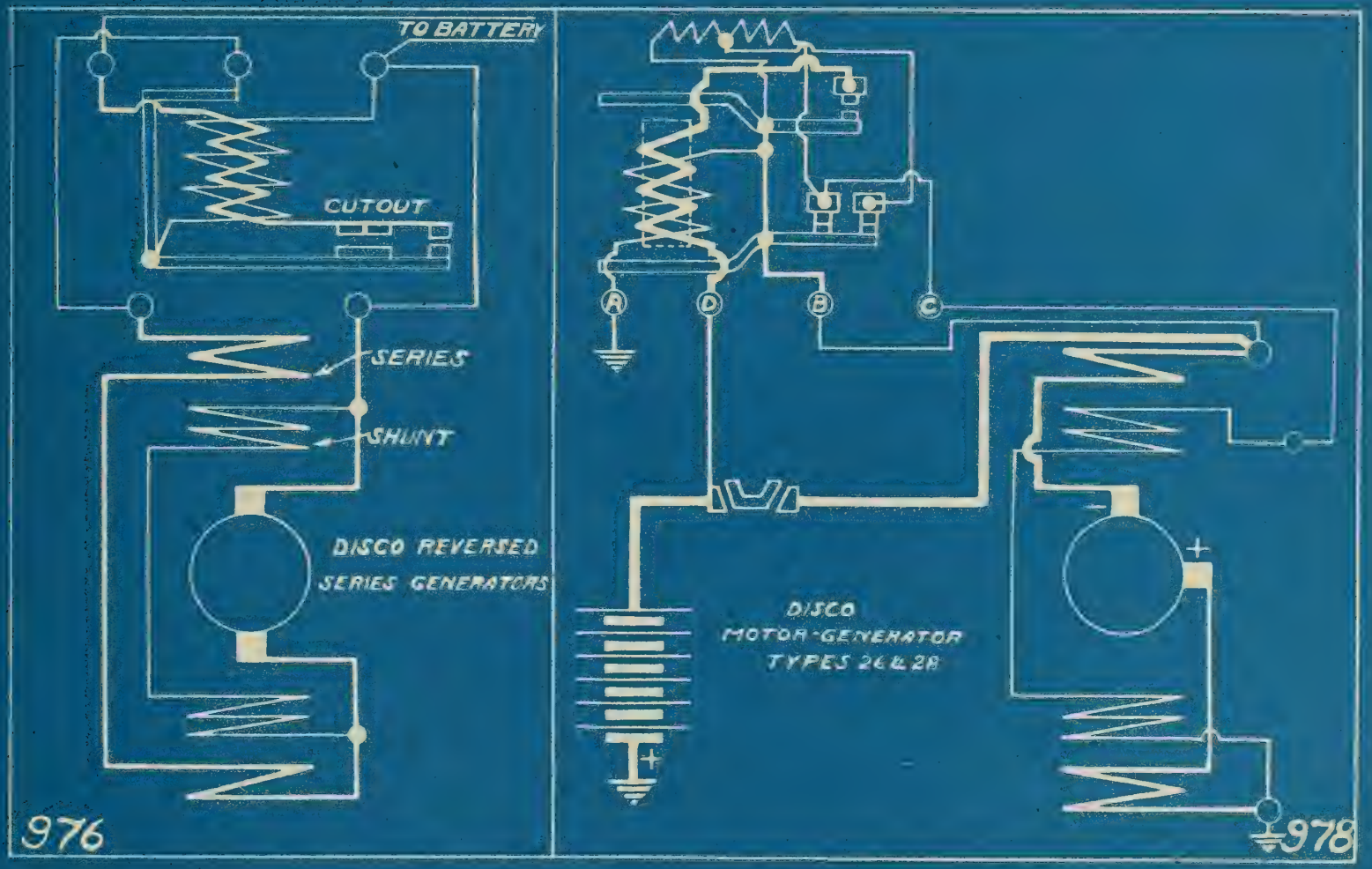
INSTALLATION FOR CARS NOT ORIGINALLY EQUIPPED.



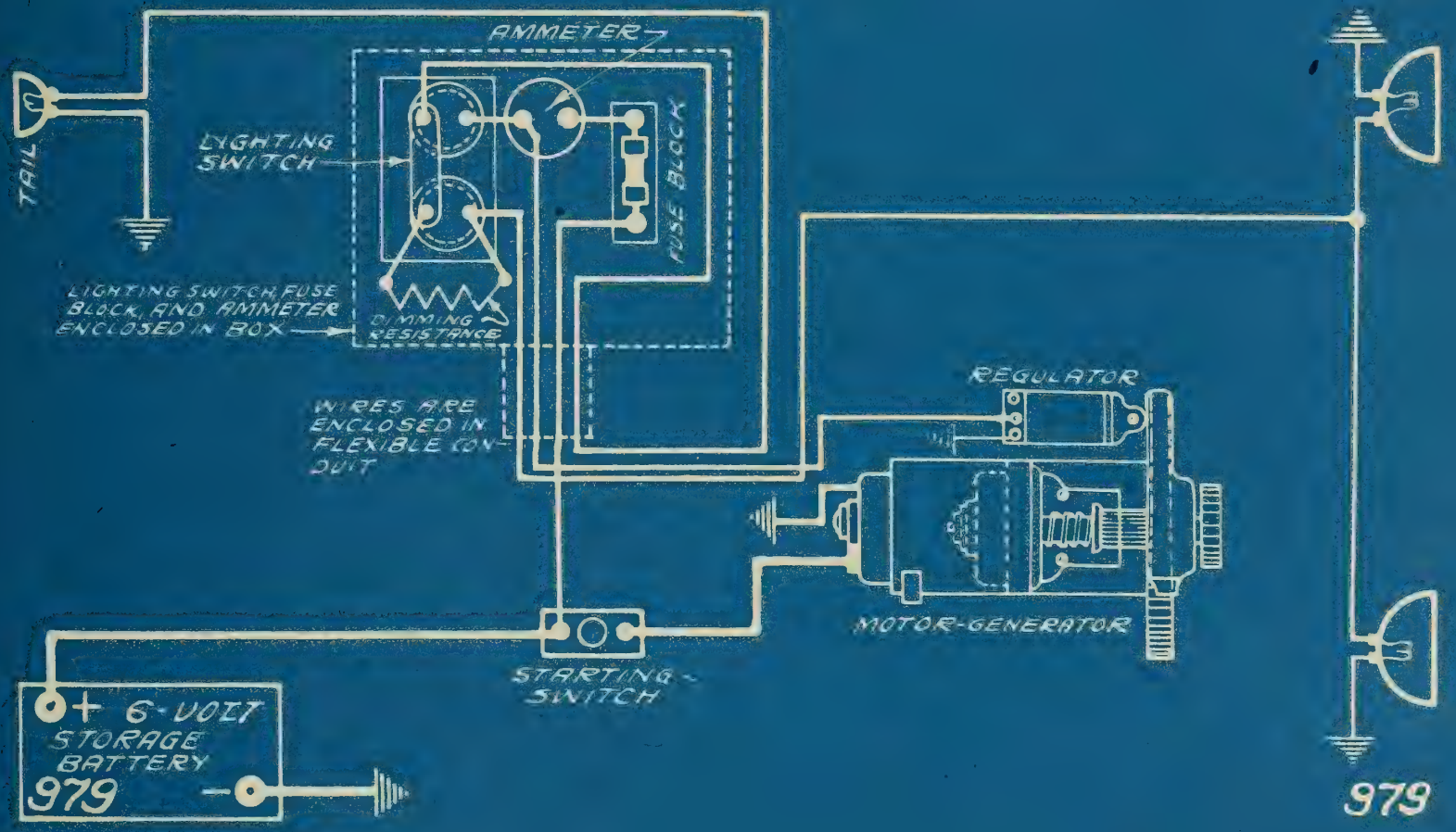
DETROIT WARD LEONARD



DISCO INTERNAL CIRCUITS

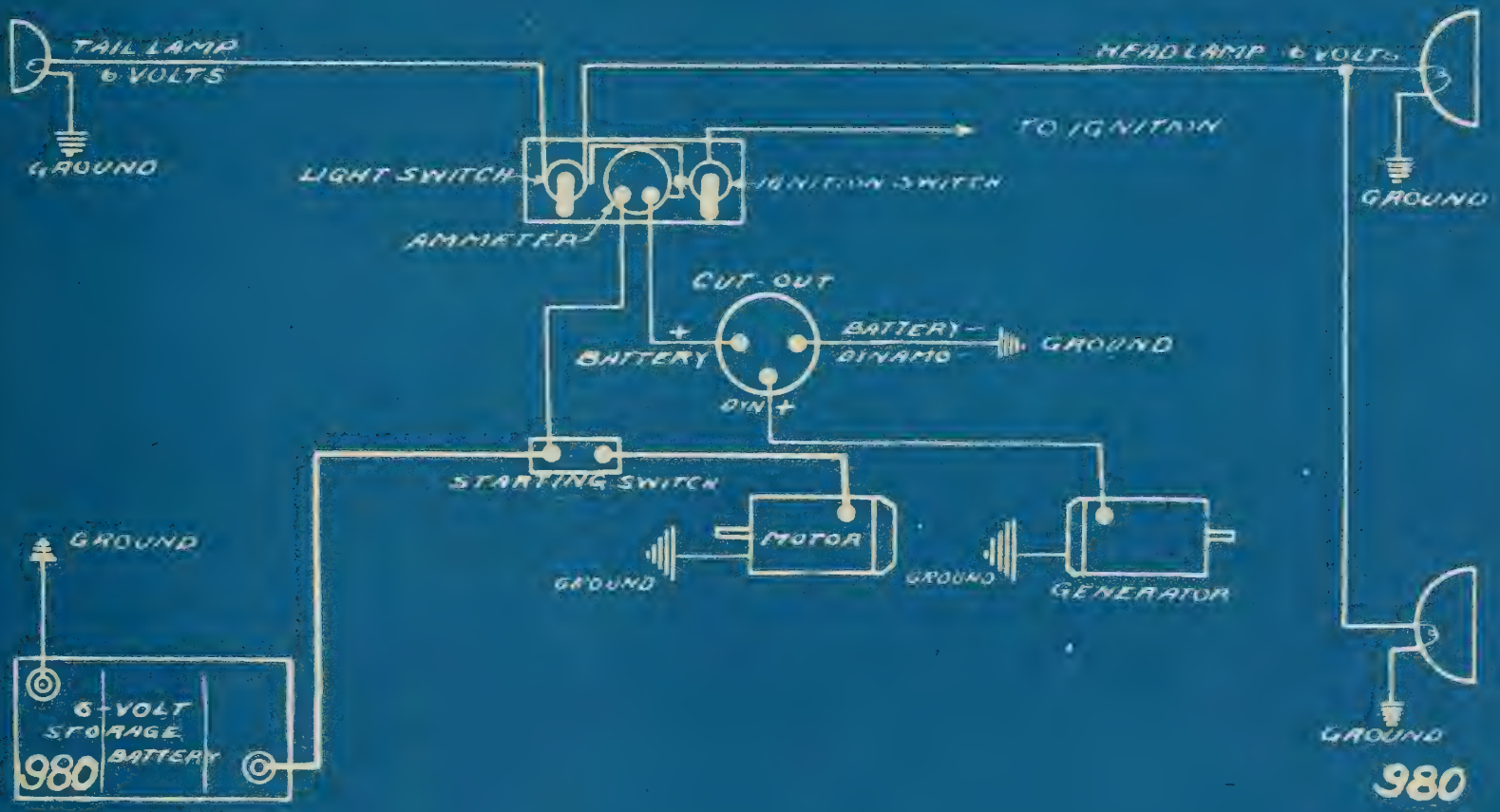


DISCO SINGLE UNIT STANDARD WIRING



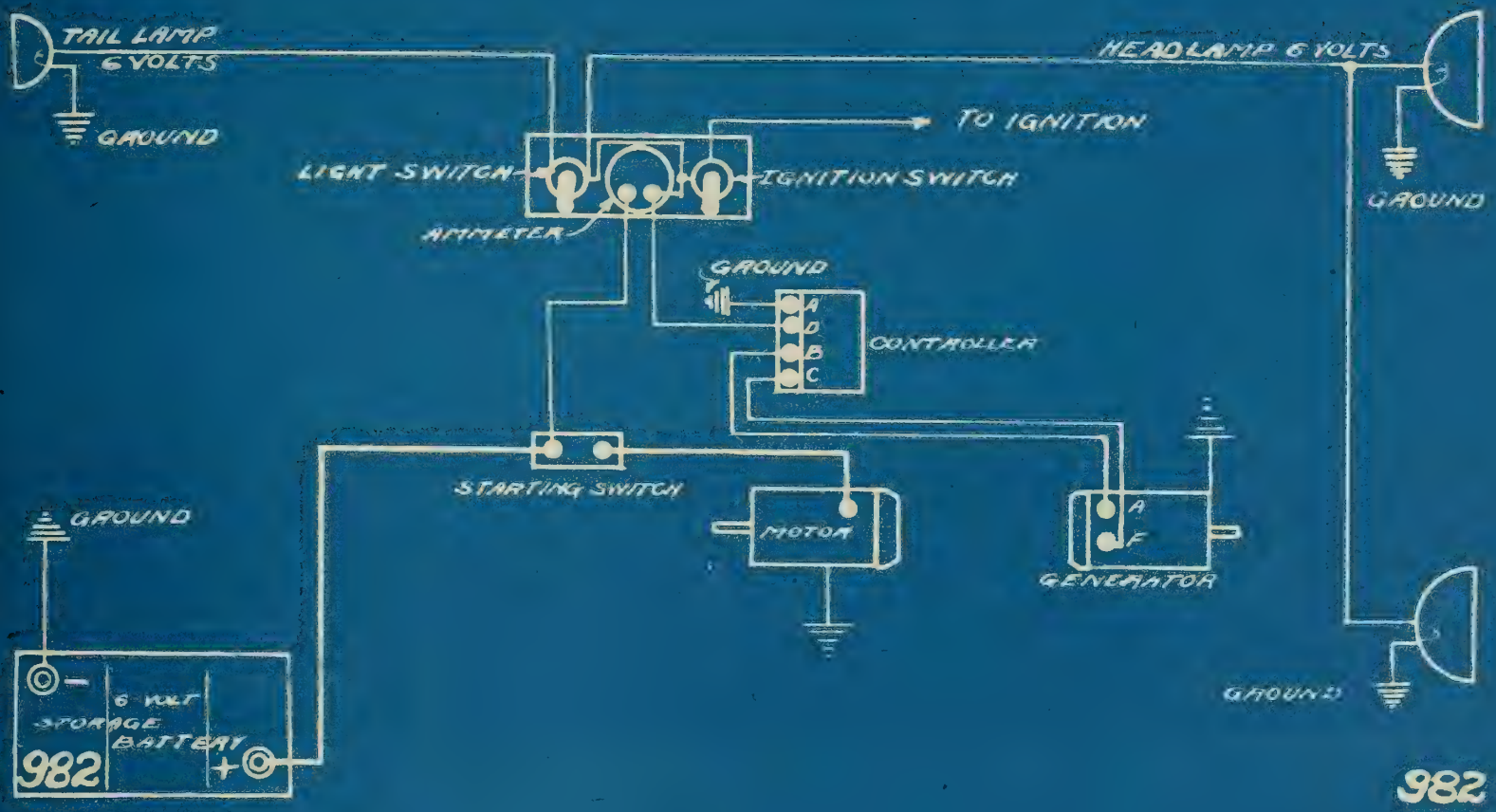
DISCO TWO UNIT STANDARD

DIAGRAM MODELS 30 TO 34



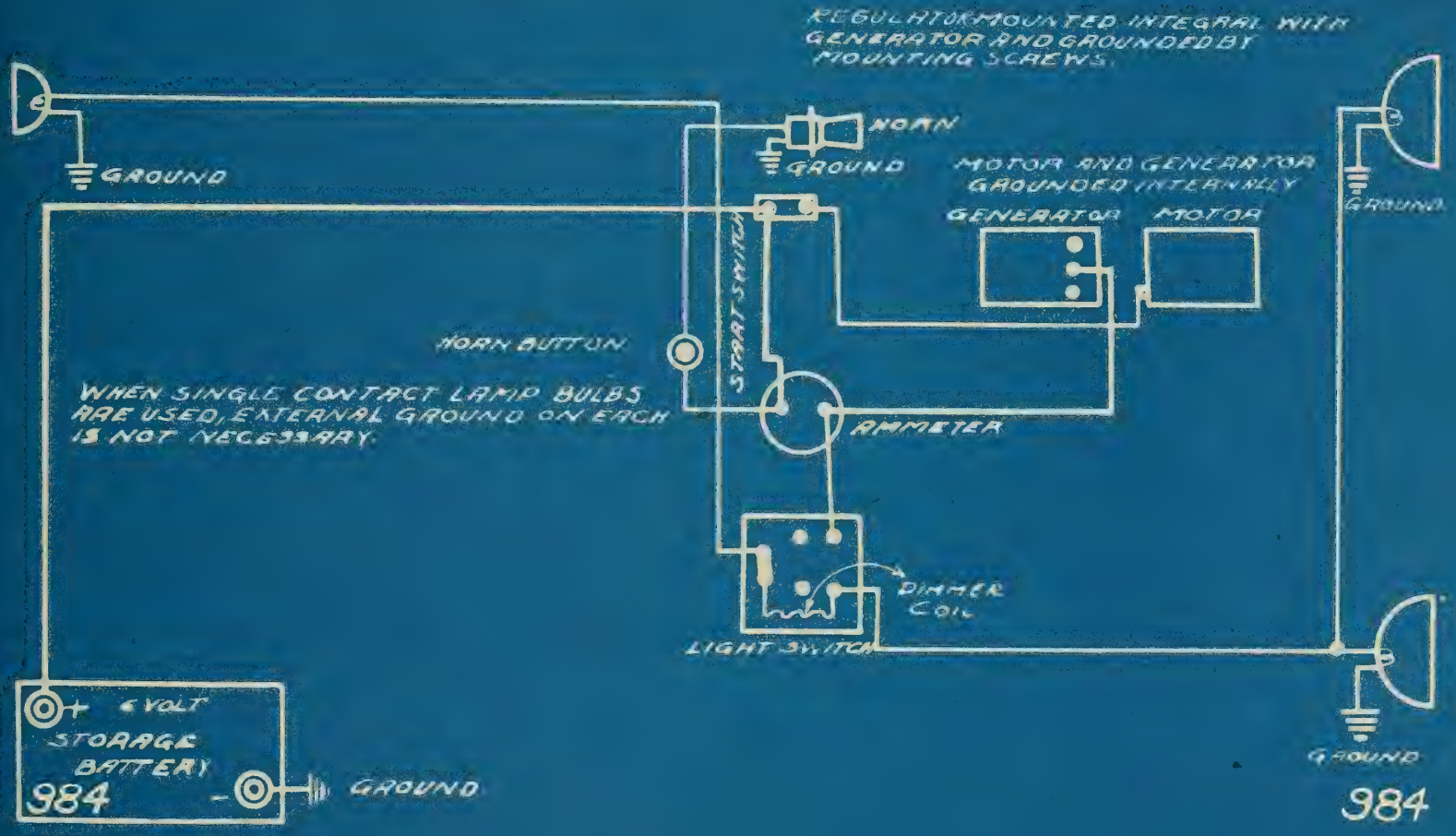
DISCO TWO UNIT STANDARD

DIAGRAM MODELS 40 TO 49

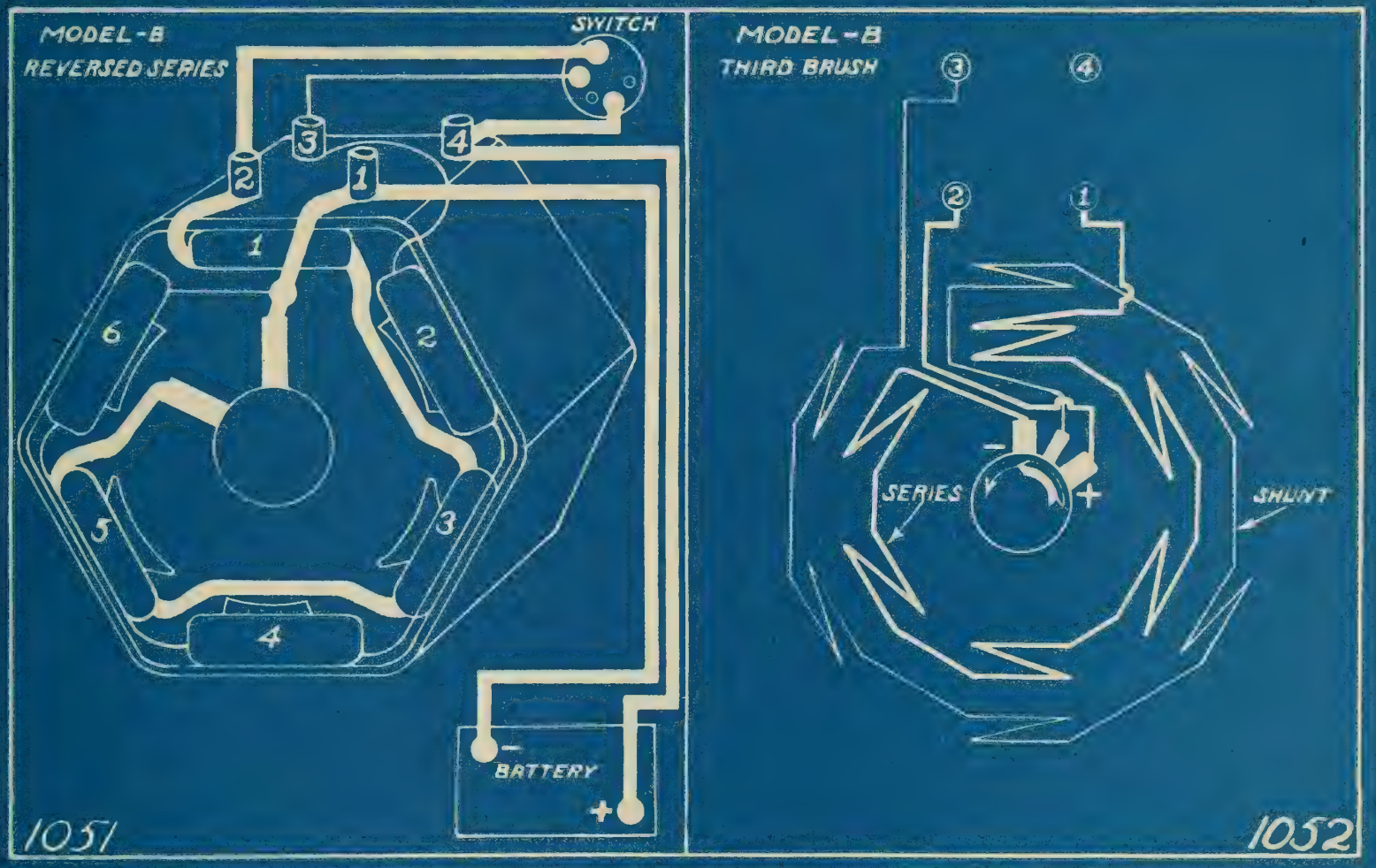


DISCO - STANDARD INSTALLATION

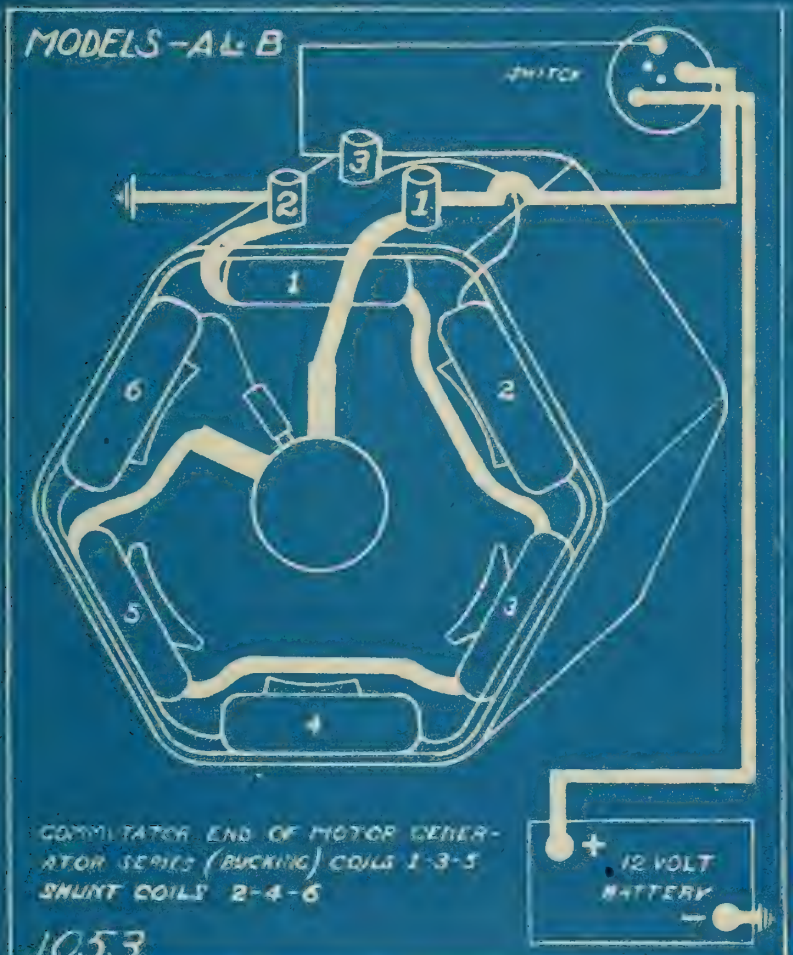
GENERATOR MOD. 100 - MOTOR MOD 200

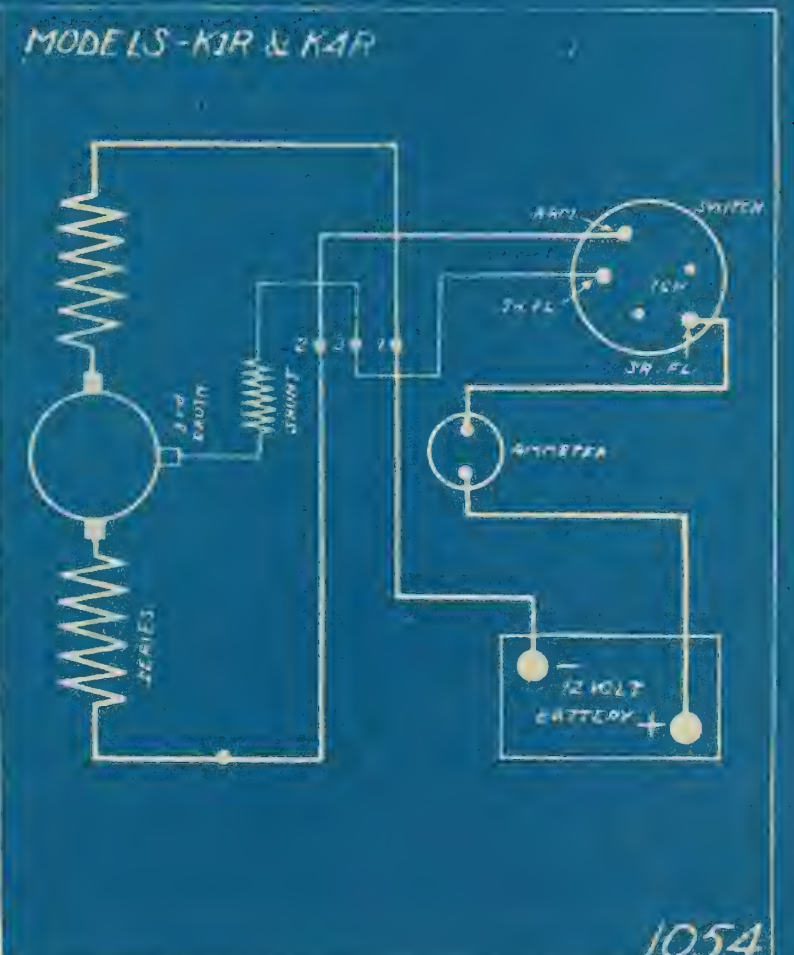


DYNETO INTERNAL CIRCUITS

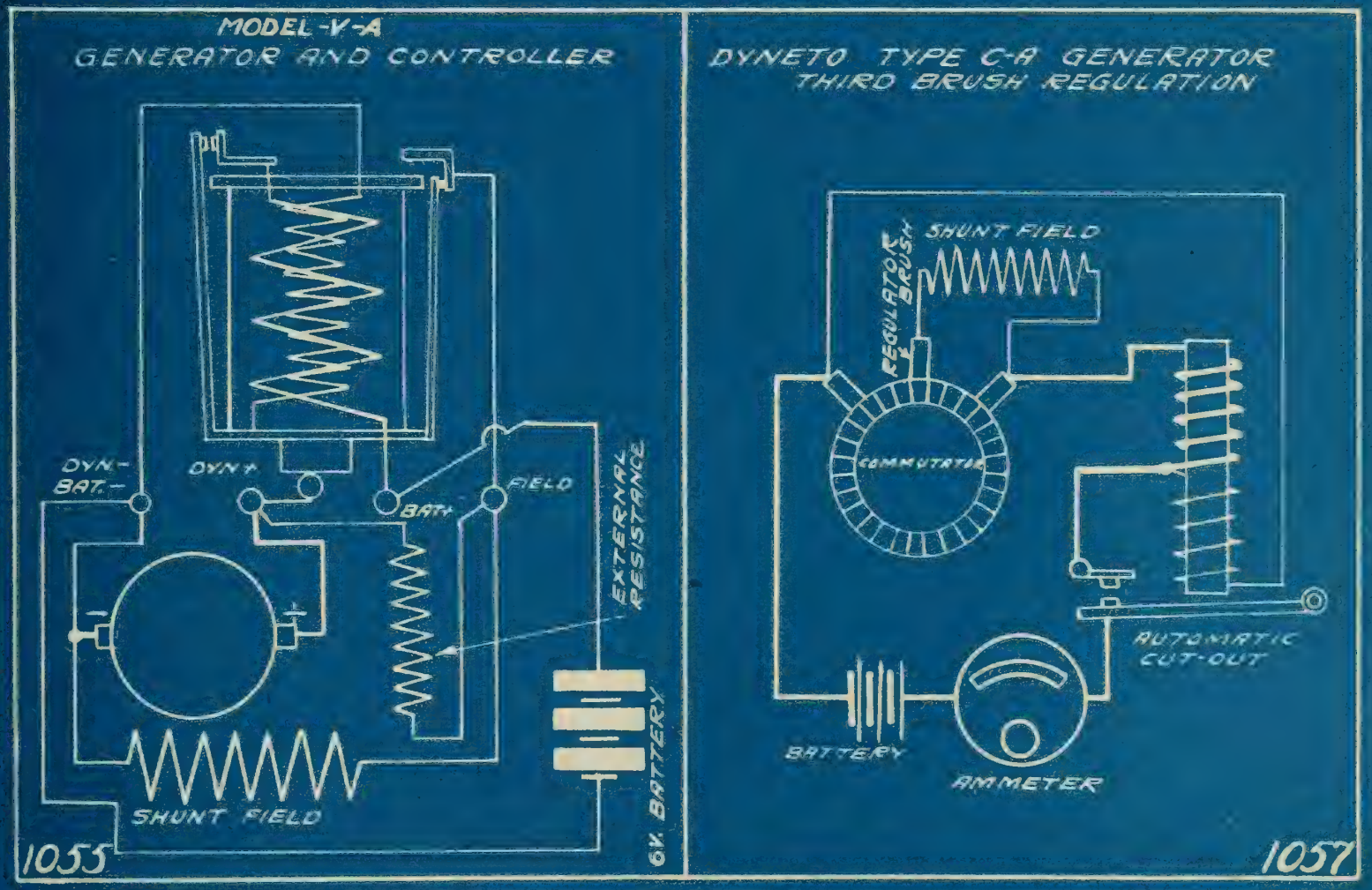


DYNETO MOTOR-GENERATOR
INTERNAL CONNECTIONS



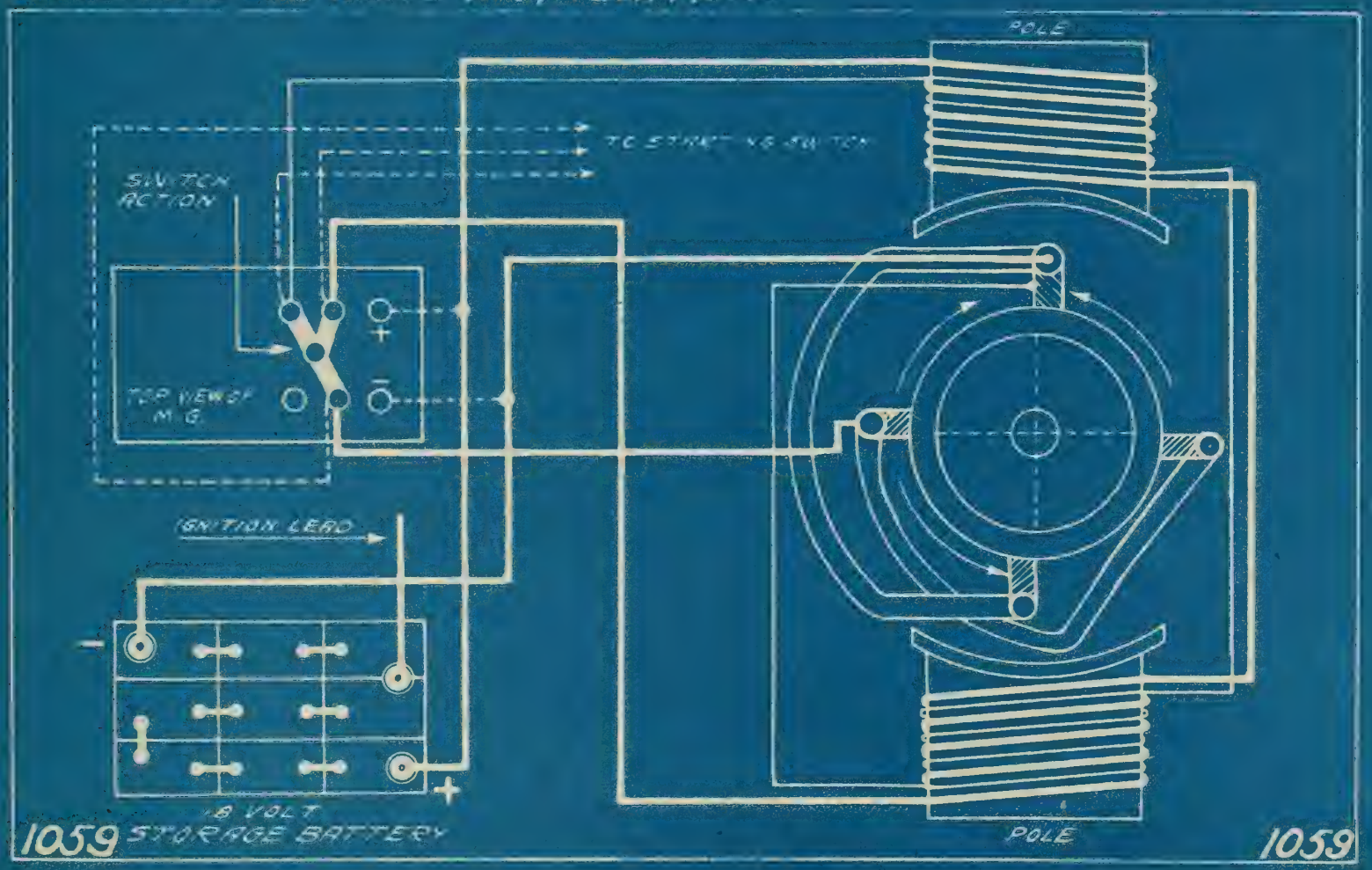


DYNETO INTERNAL CIRCUITS

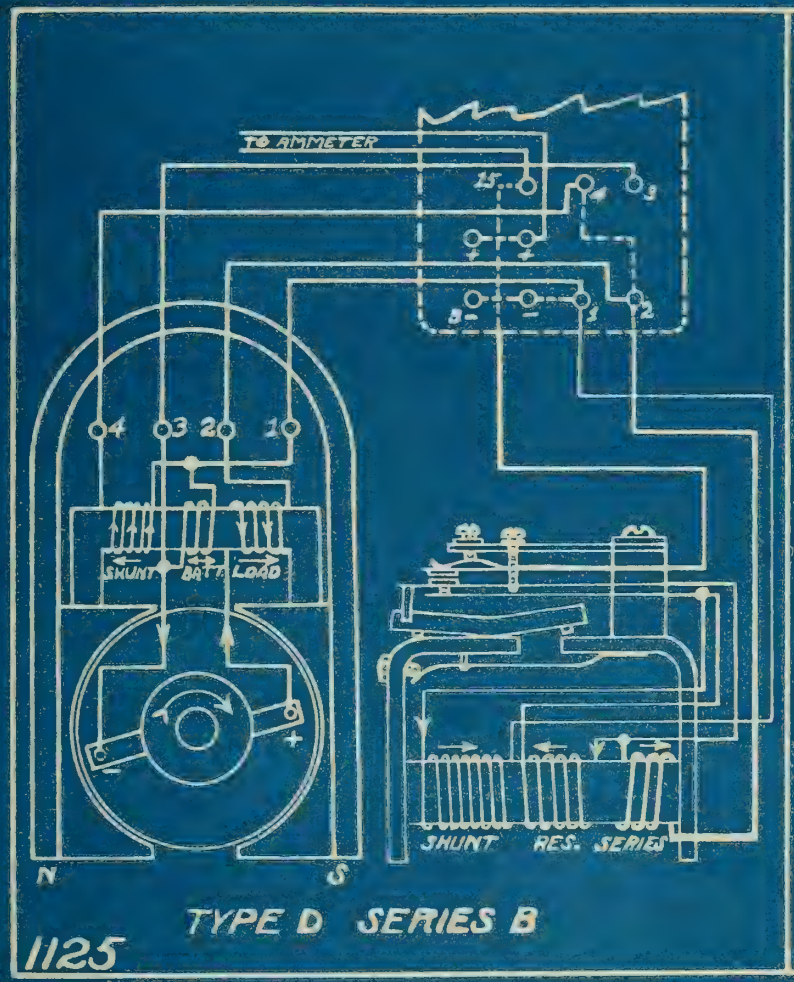


DYNETO-ENTZ INTERNAL CIRCUITS

CHALMERS AND WHITE INSTALLATION.

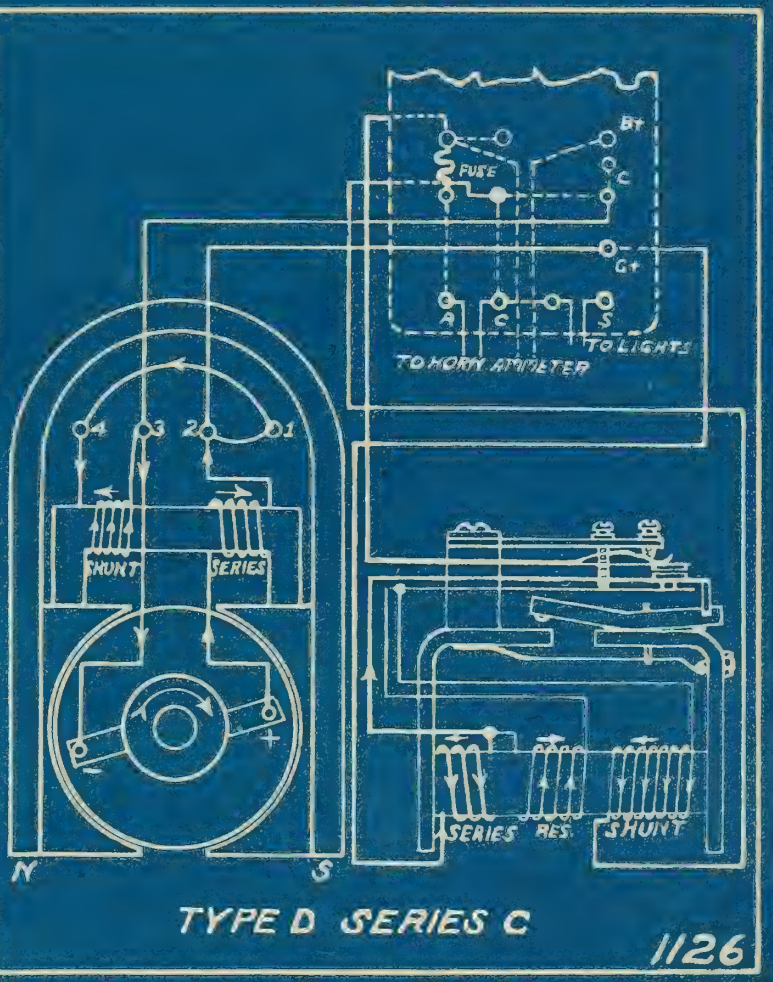


ESTERLINE INTERNAL CIRCUITS



TYPE D SERIES B

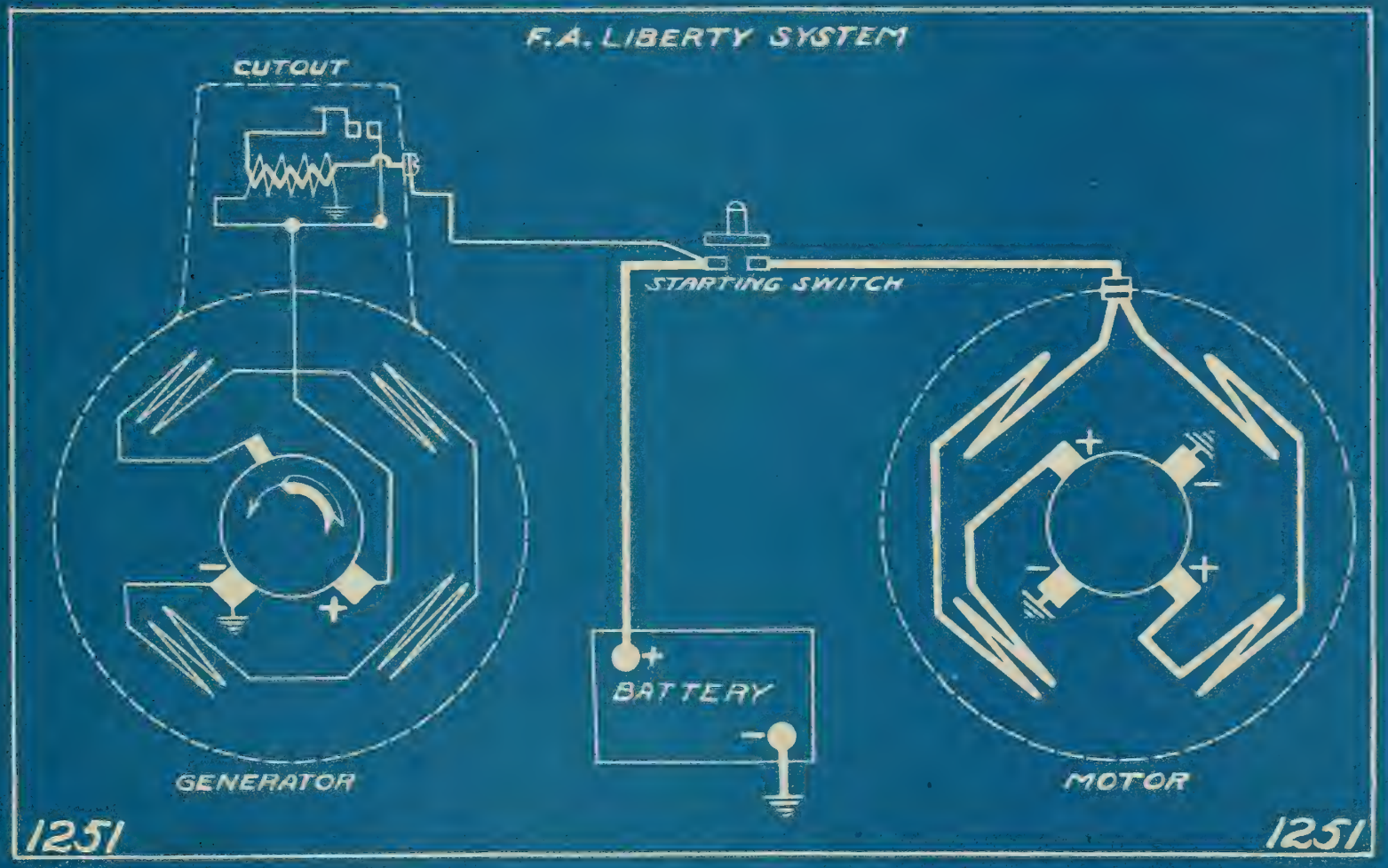
1125



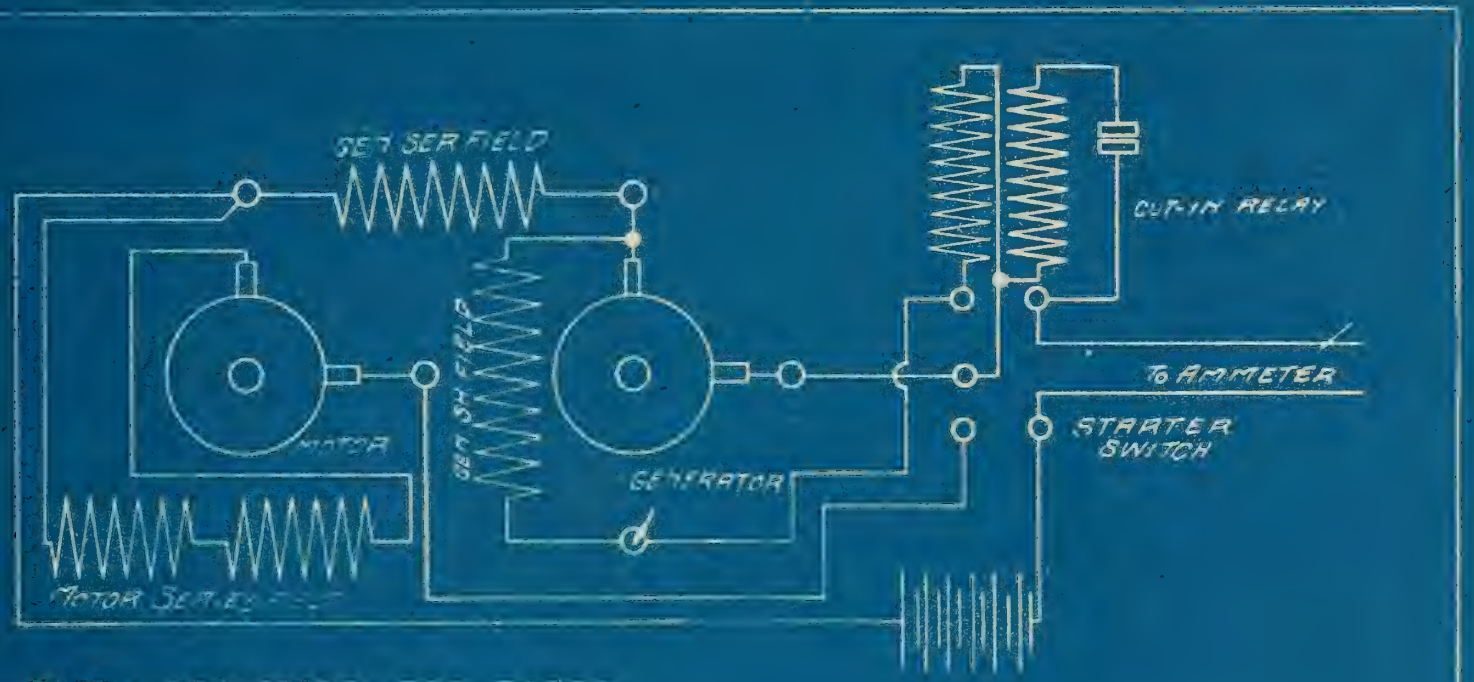
TYPE D SERIES C

1126

FORD INTERNAL CIRCUITS



FISHER INTERNAL CIRCUITS

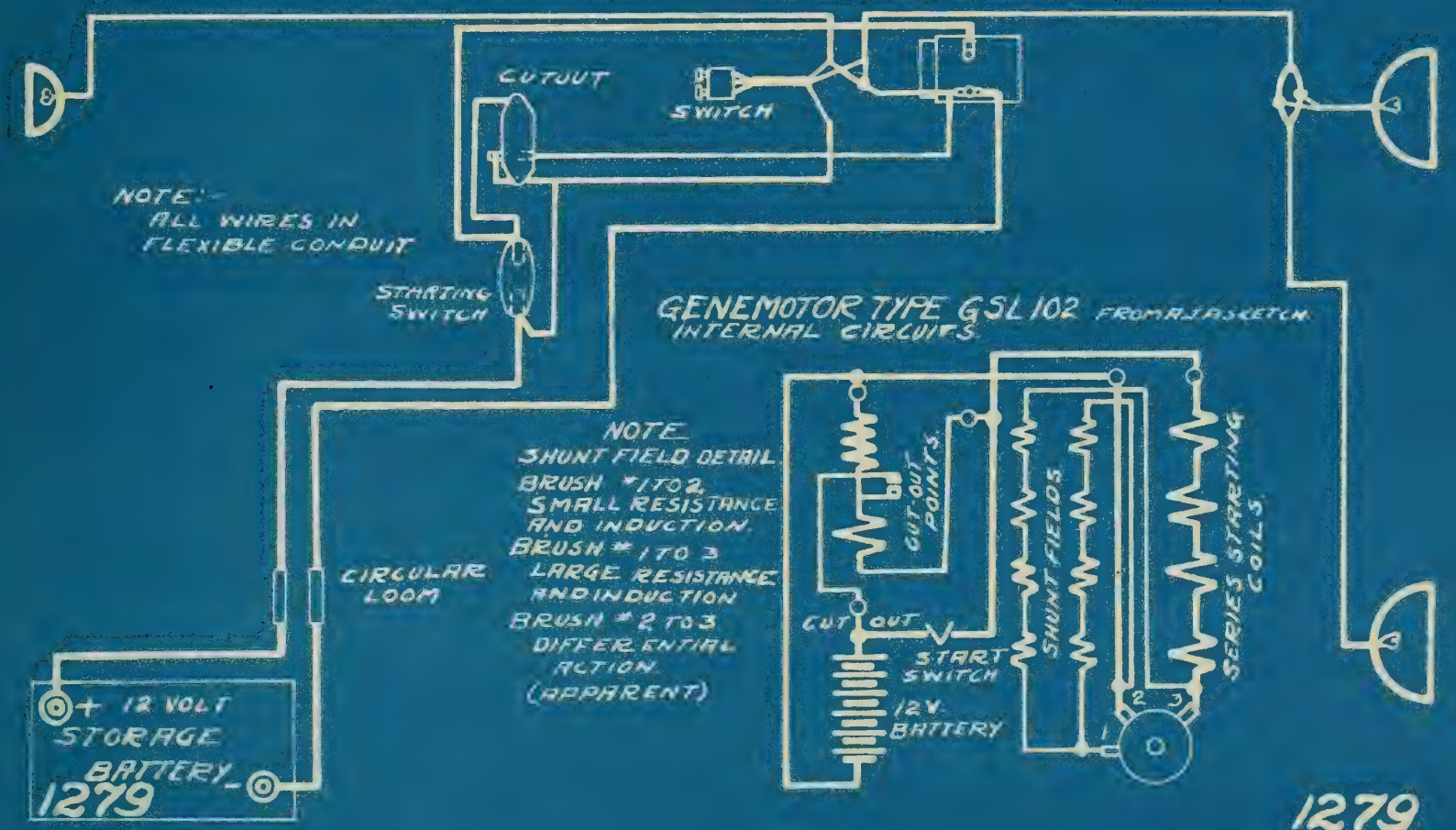


DOUBLE DECK MODEL FOR FORDS

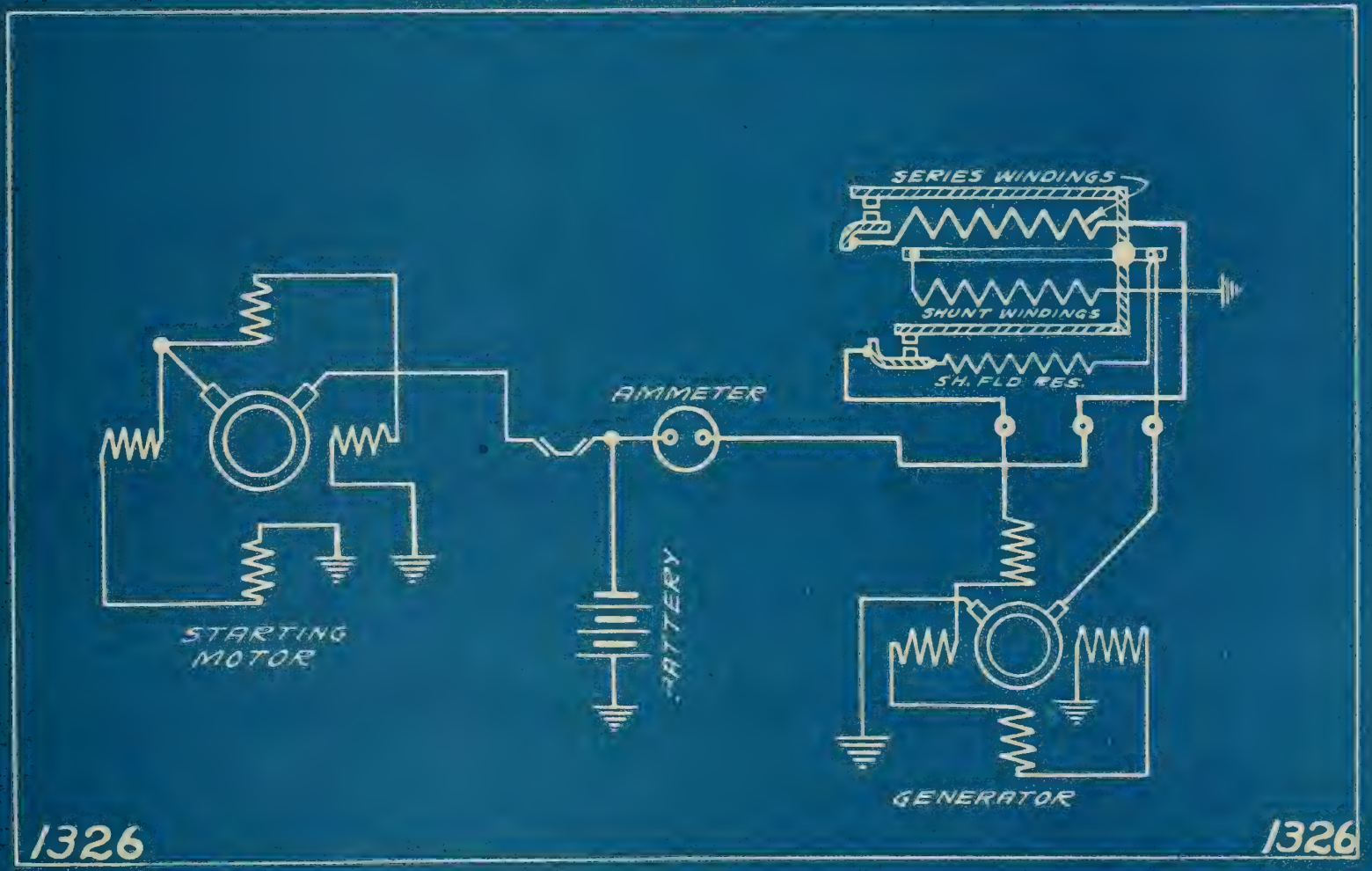
1275

1275

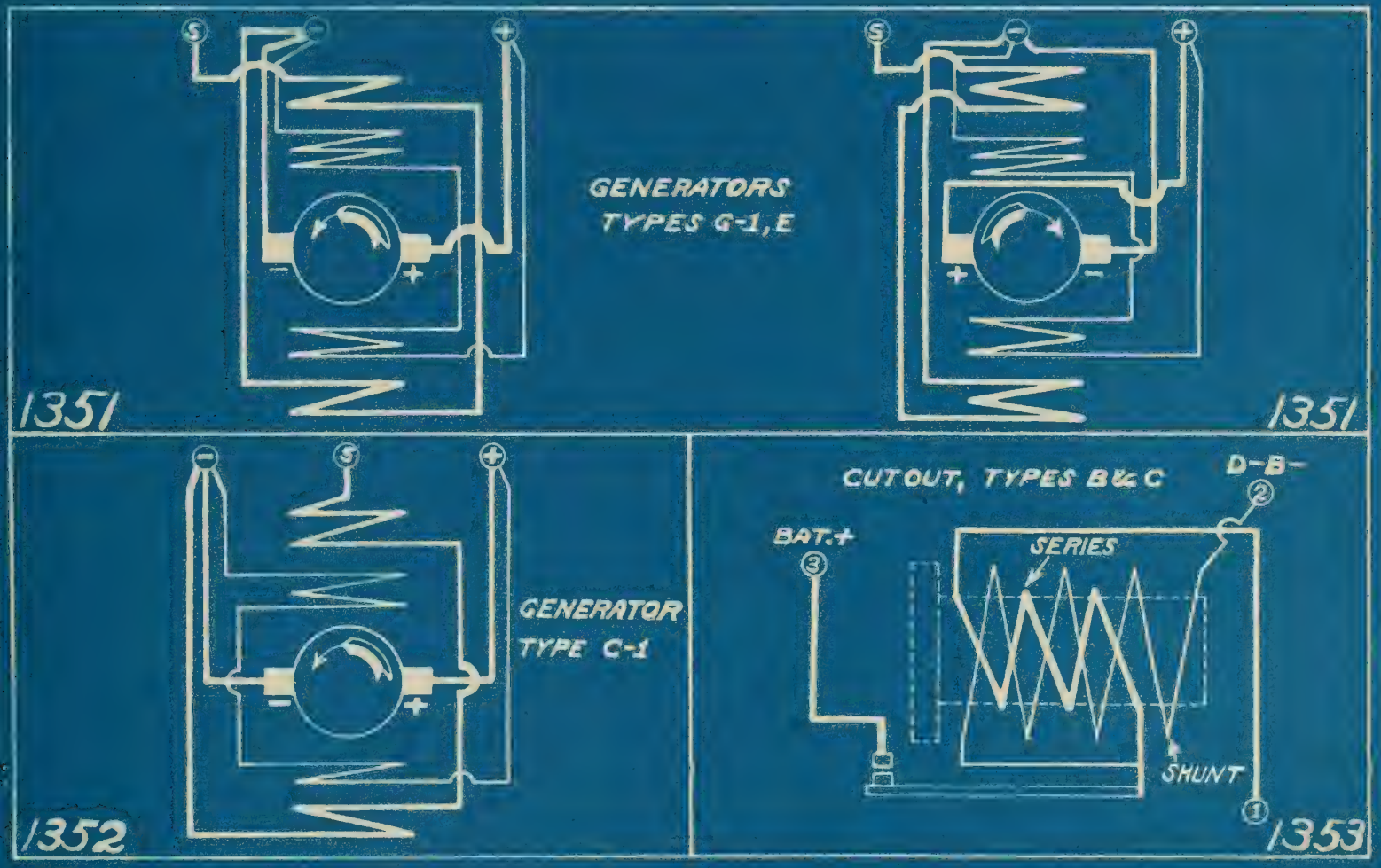
GENEMOTOR TYPE GSL 102
WIRING AND INTERNAL CIRCUITS



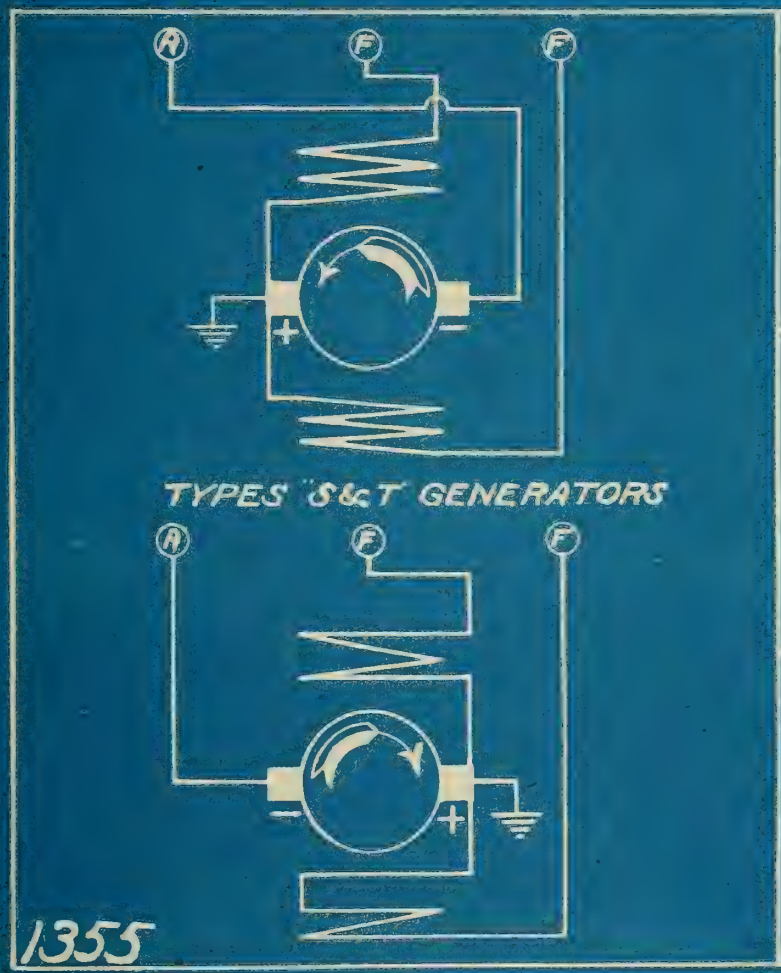
HEINZE-SPRINGFIELD INTERNAL CIRCUITS
TWO UNIT SYSTEM

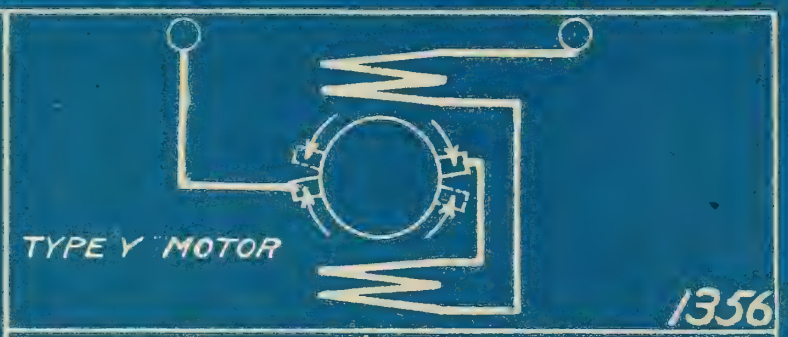


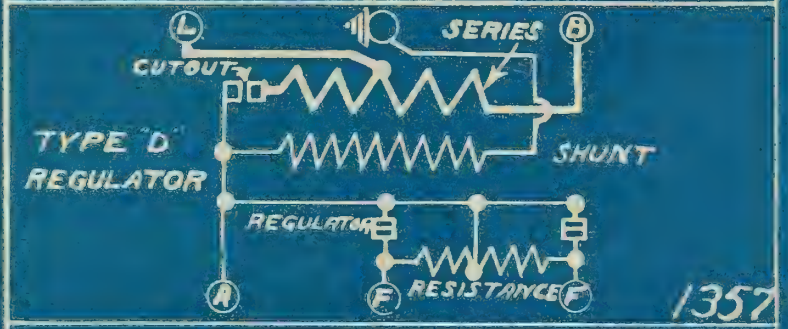
GRAY & DAVIS INTERNAL CIRCUITS

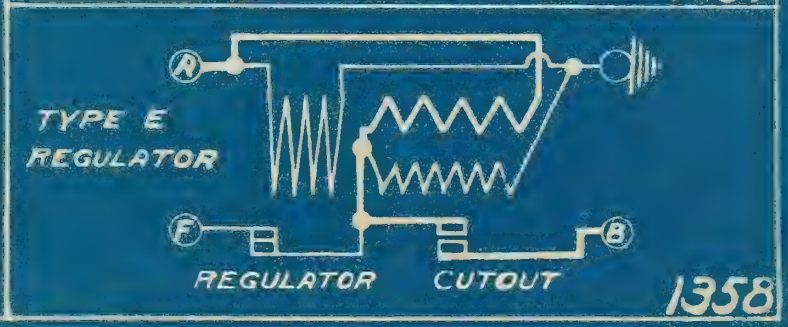


GRAY & DAVIS INTERNAL CIRCUITS



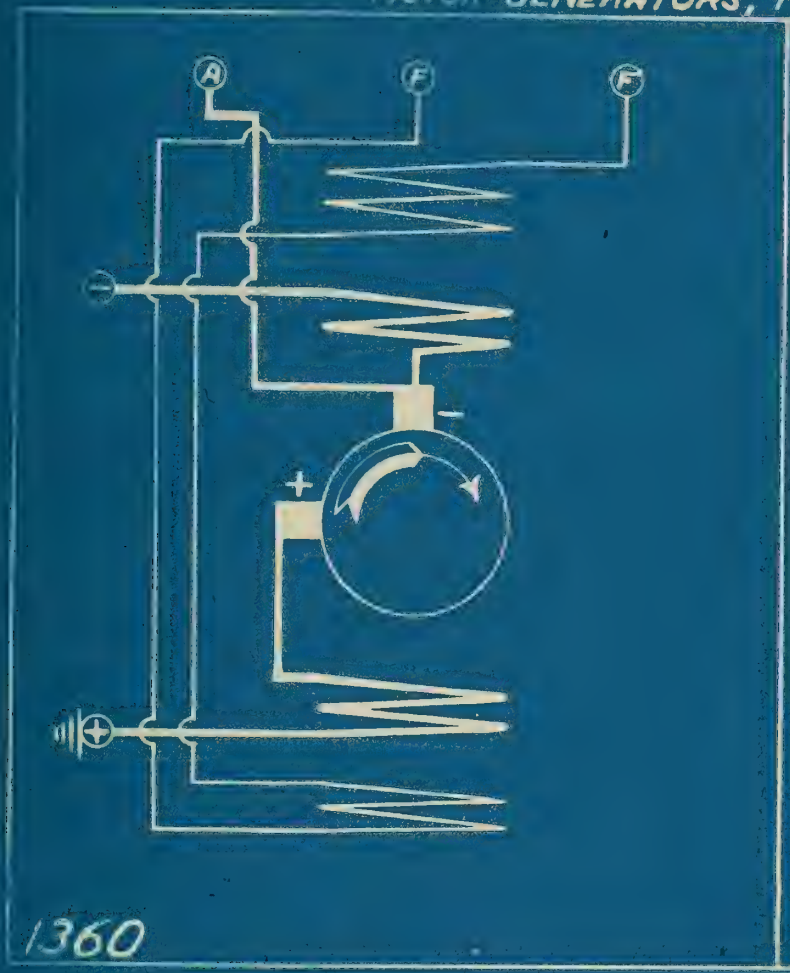


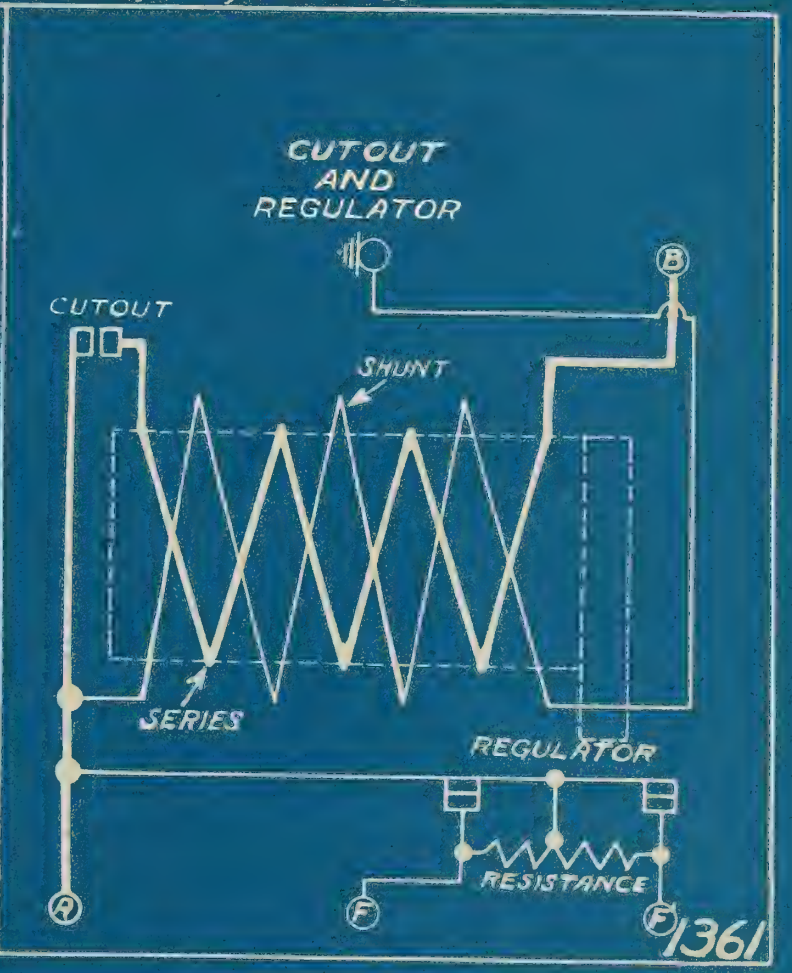




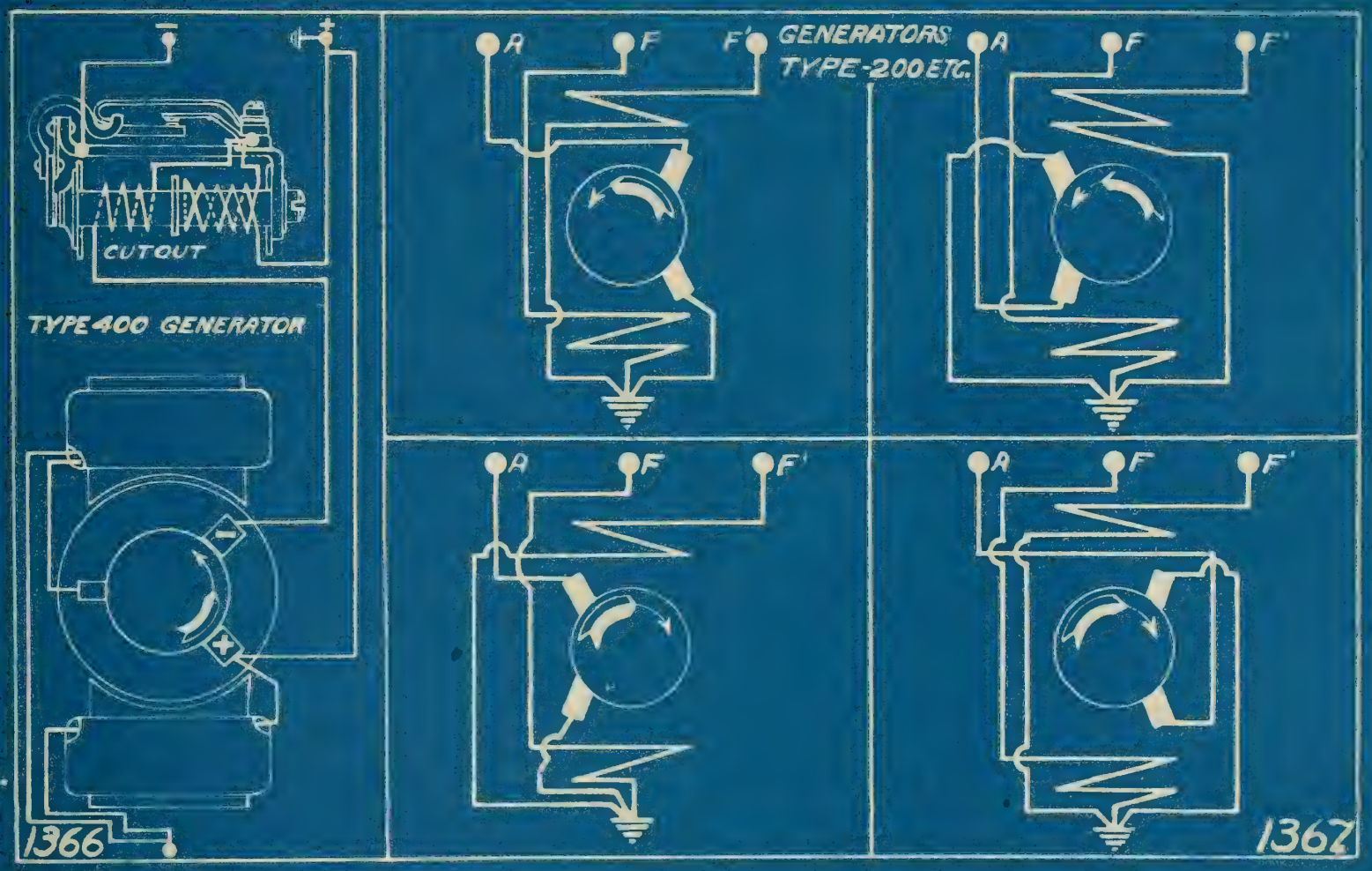
GRAY & DAVIS INTERNAL CIRCUITS

MOTOR-GENERATORS, TYPES 9, 300, 301 ETC.



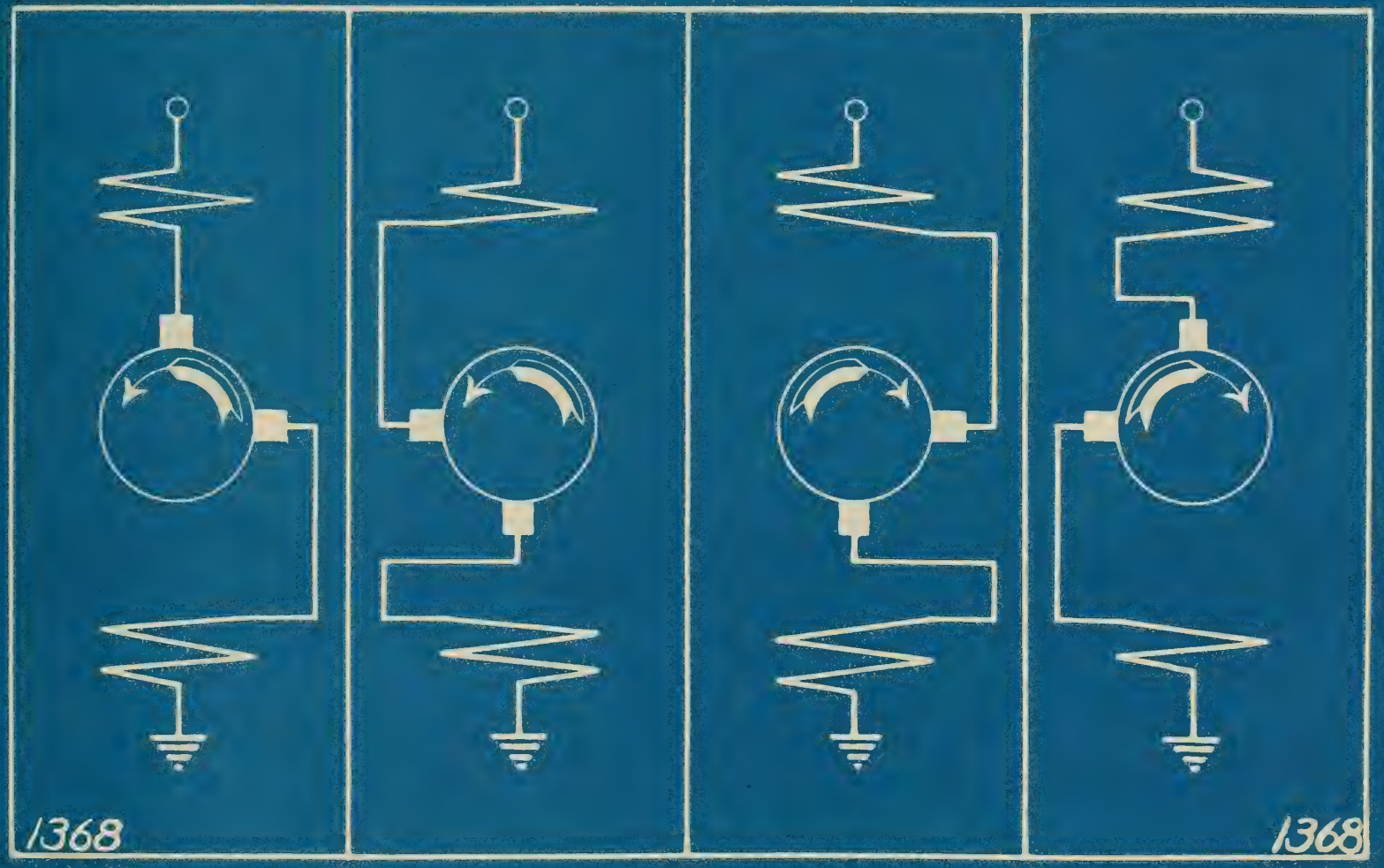


GRAY & DAVIS INTERNAL CIRCUITS



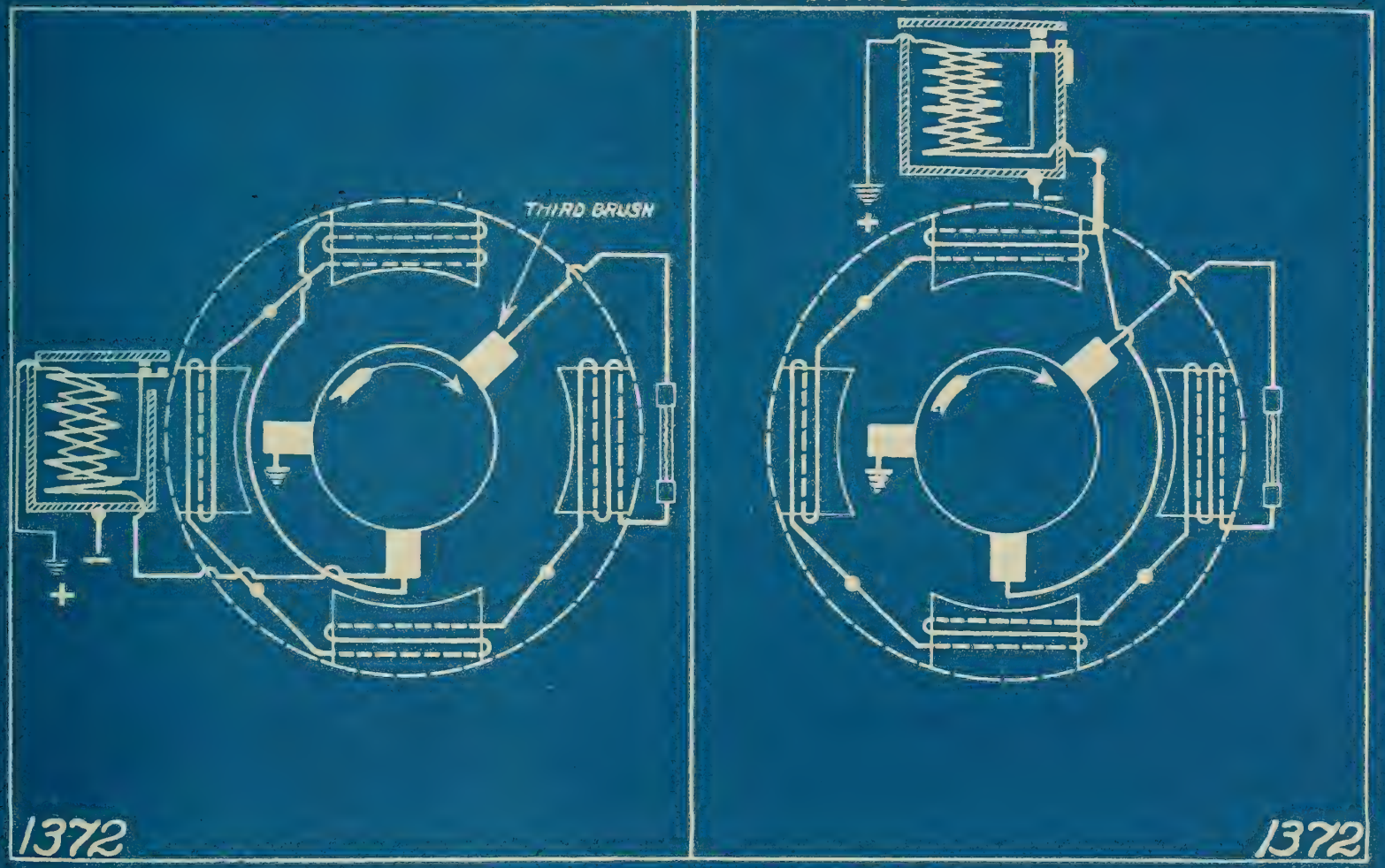
GRAY & DAVIS INTERNAL CIRCUITS

TYPE 100 ETC. MOTORS



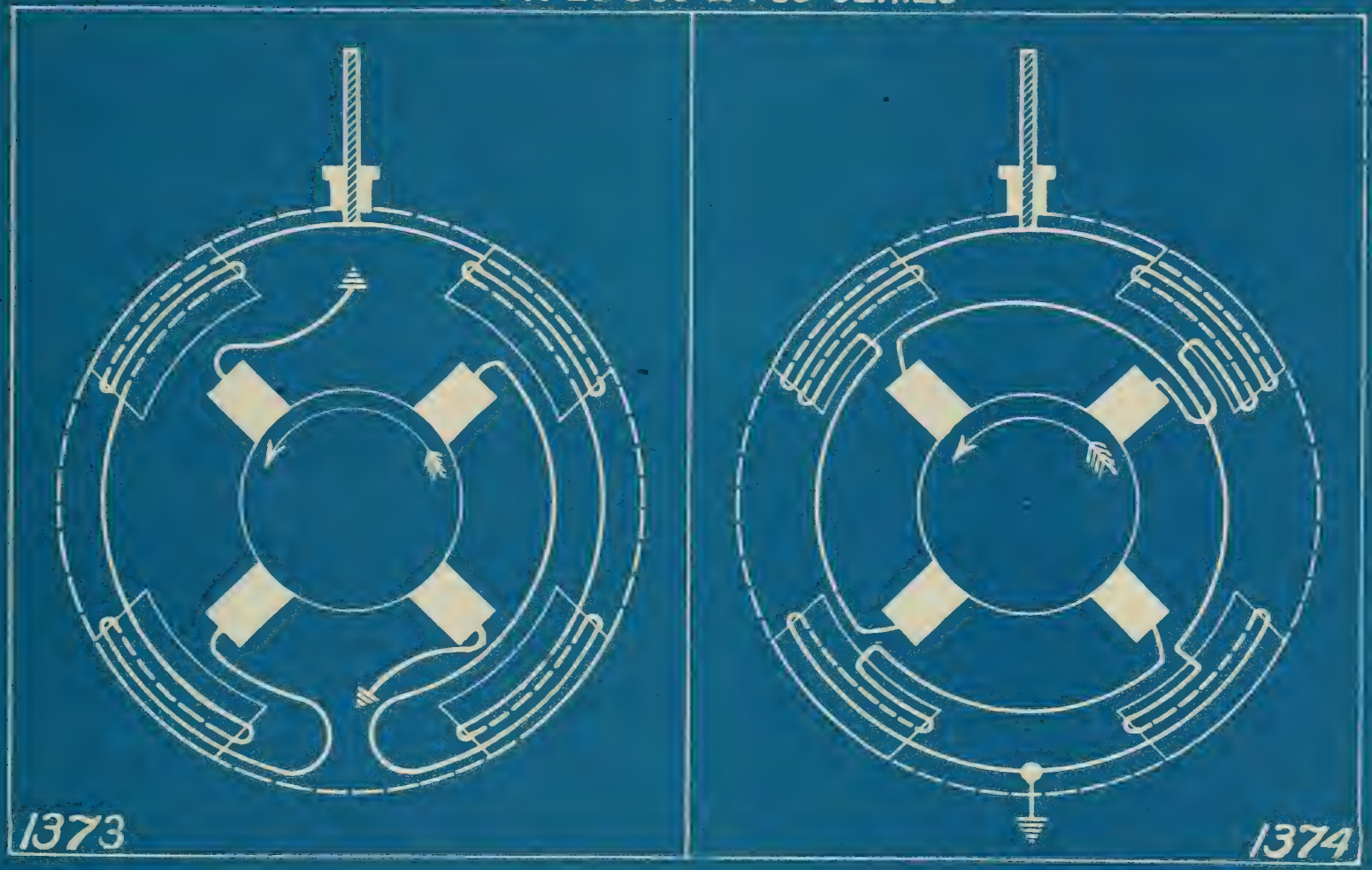
GRAY & DAVIS GENERATORS

TYPES 600 & 800 SERIES



GRAY & DAVIS STARTING MOTORS

TYPES 500 & 700 SERIES

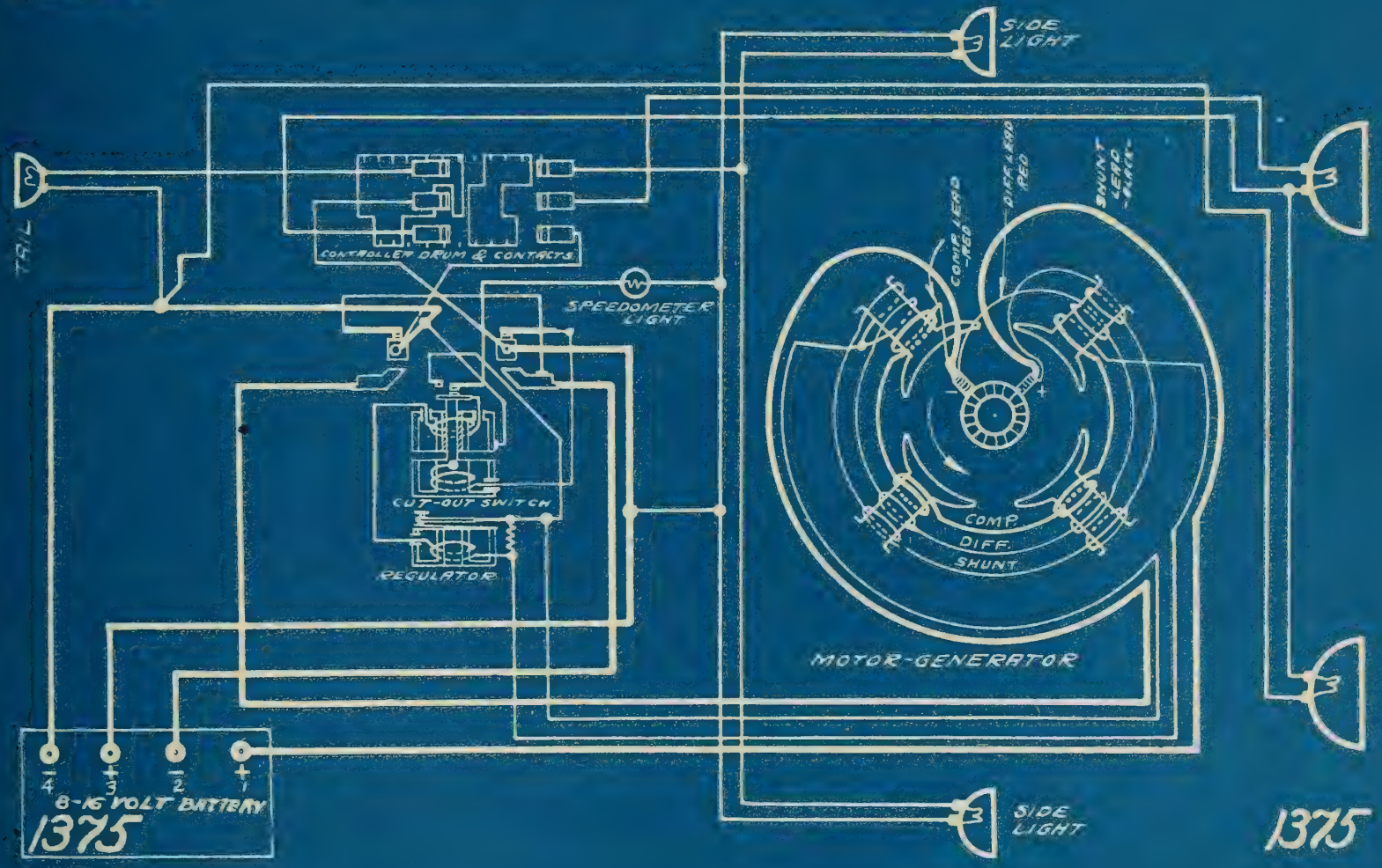


1373

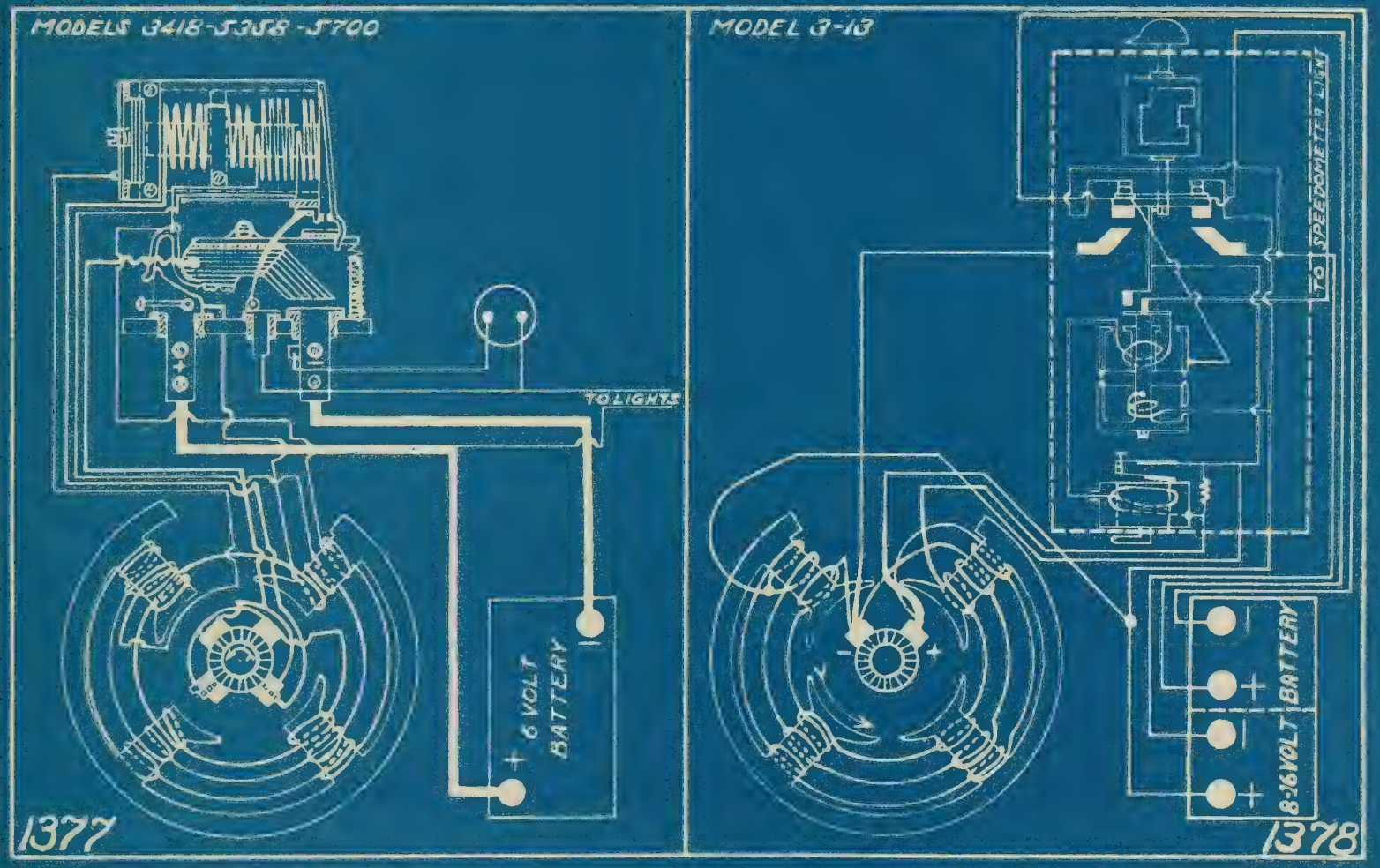
1374

JESCO INTERNAL CIRCUITS

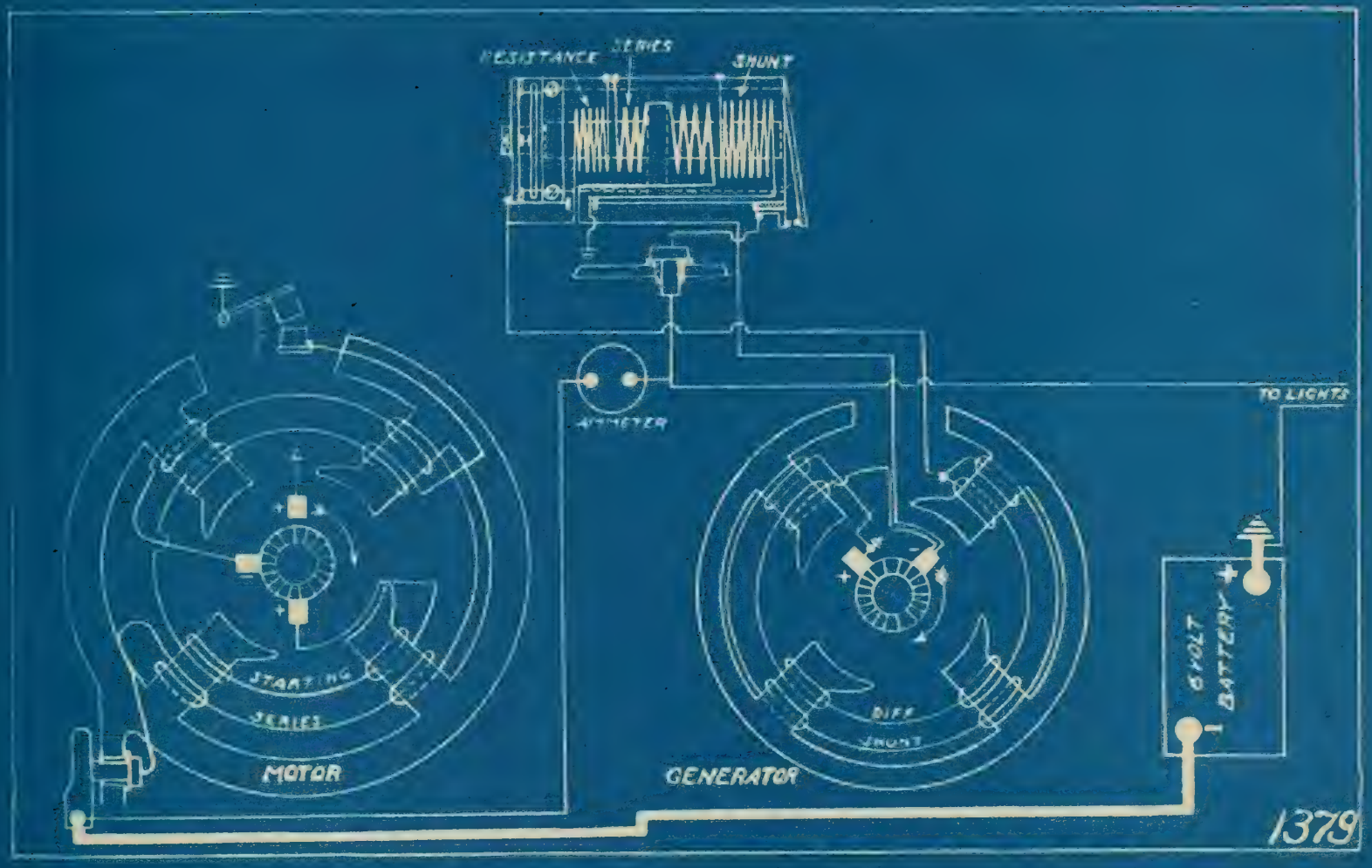
SIZE 3-13



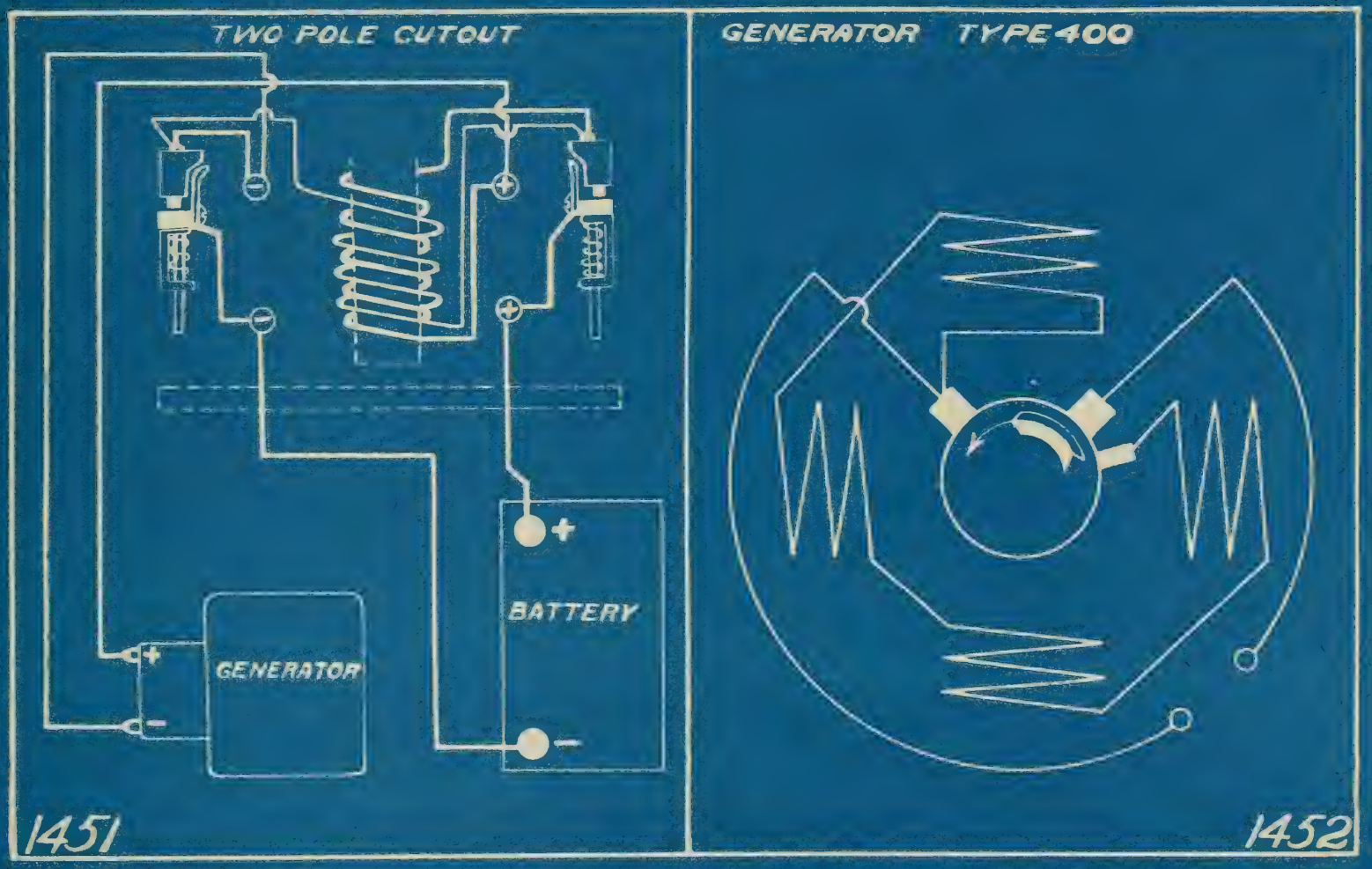
JESCO MOTOR-GENERATORS



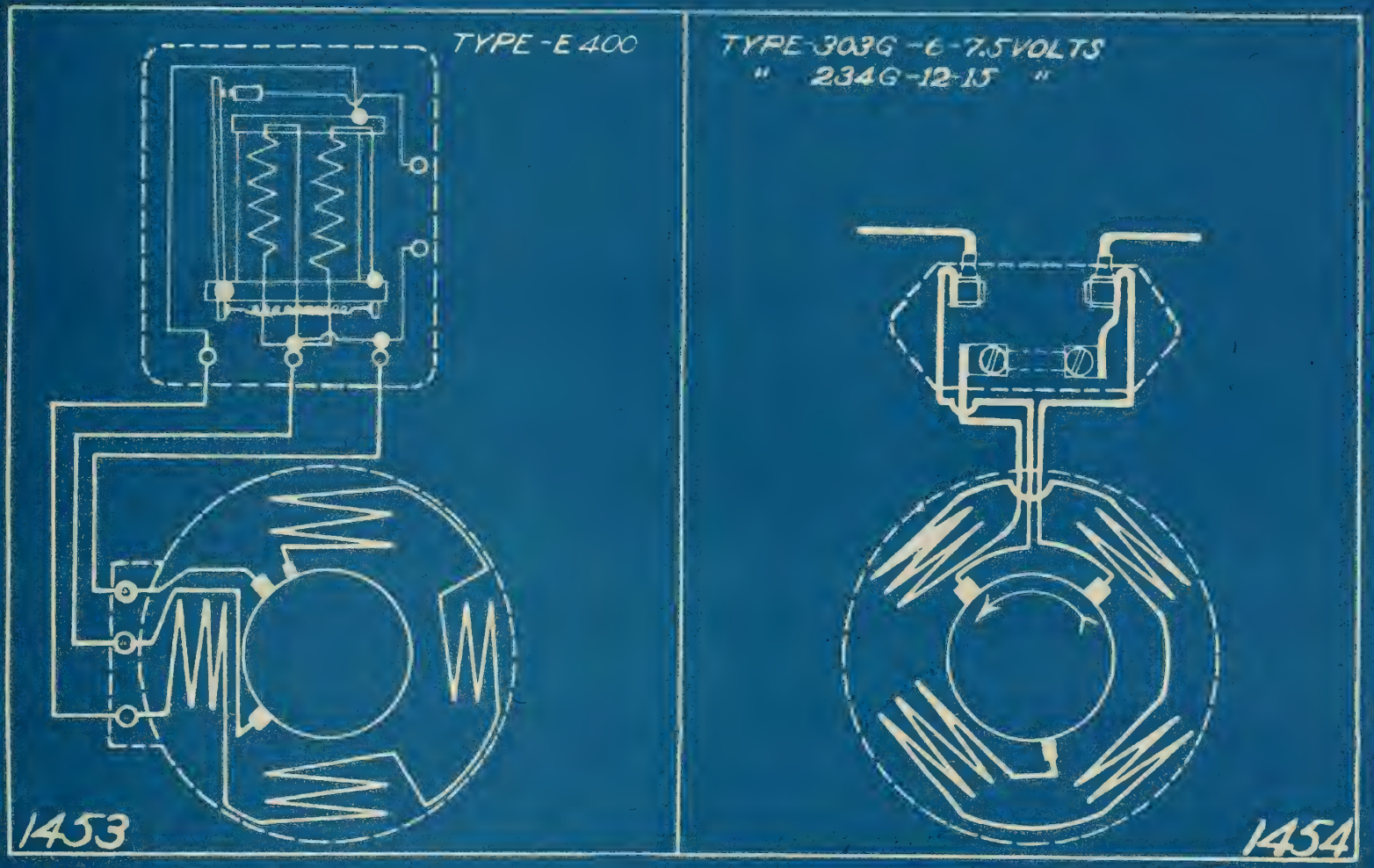
JESCO MODEL-7



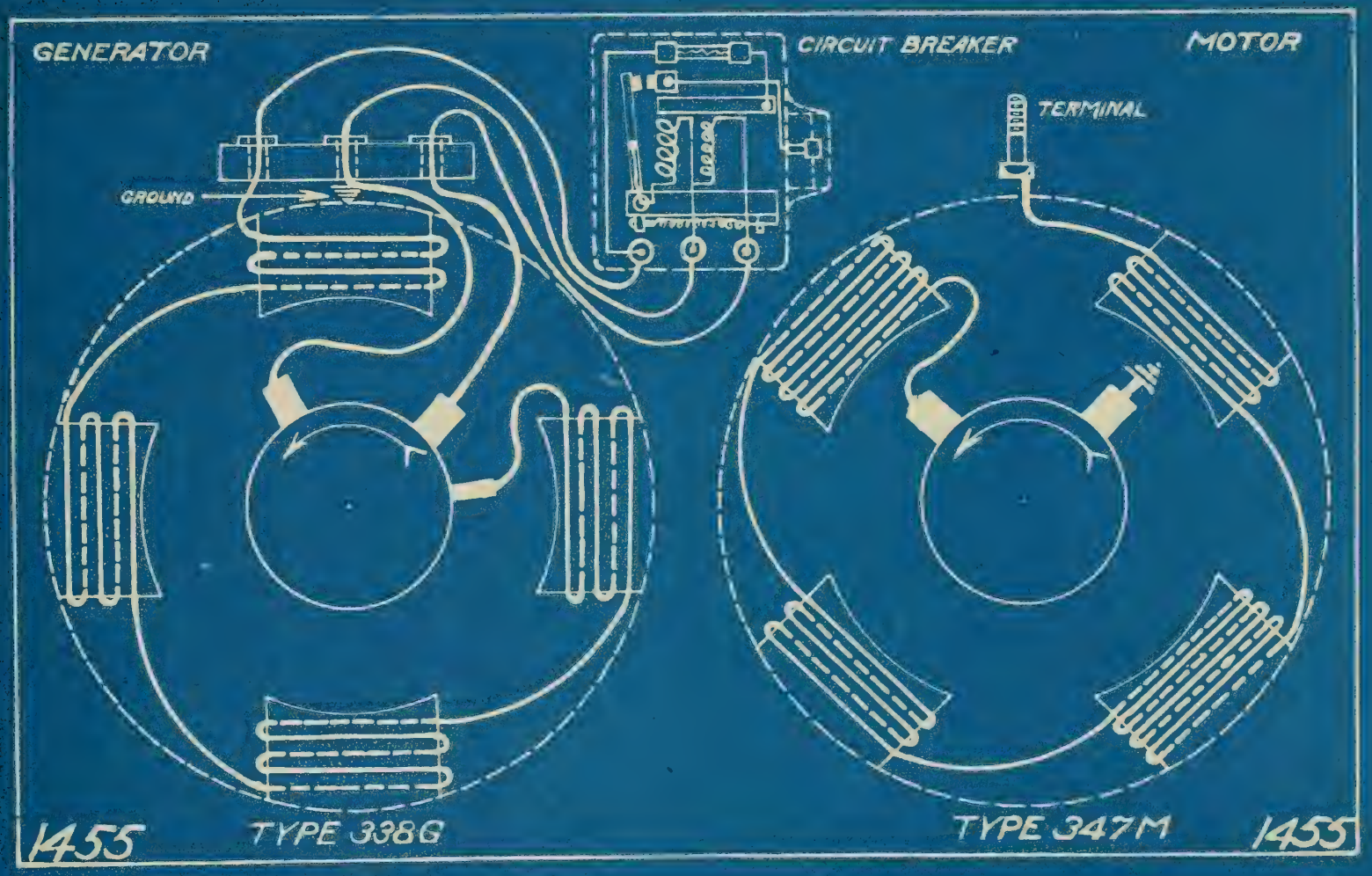
LEECE-NEVILLE INTERNAL CIRCUITS



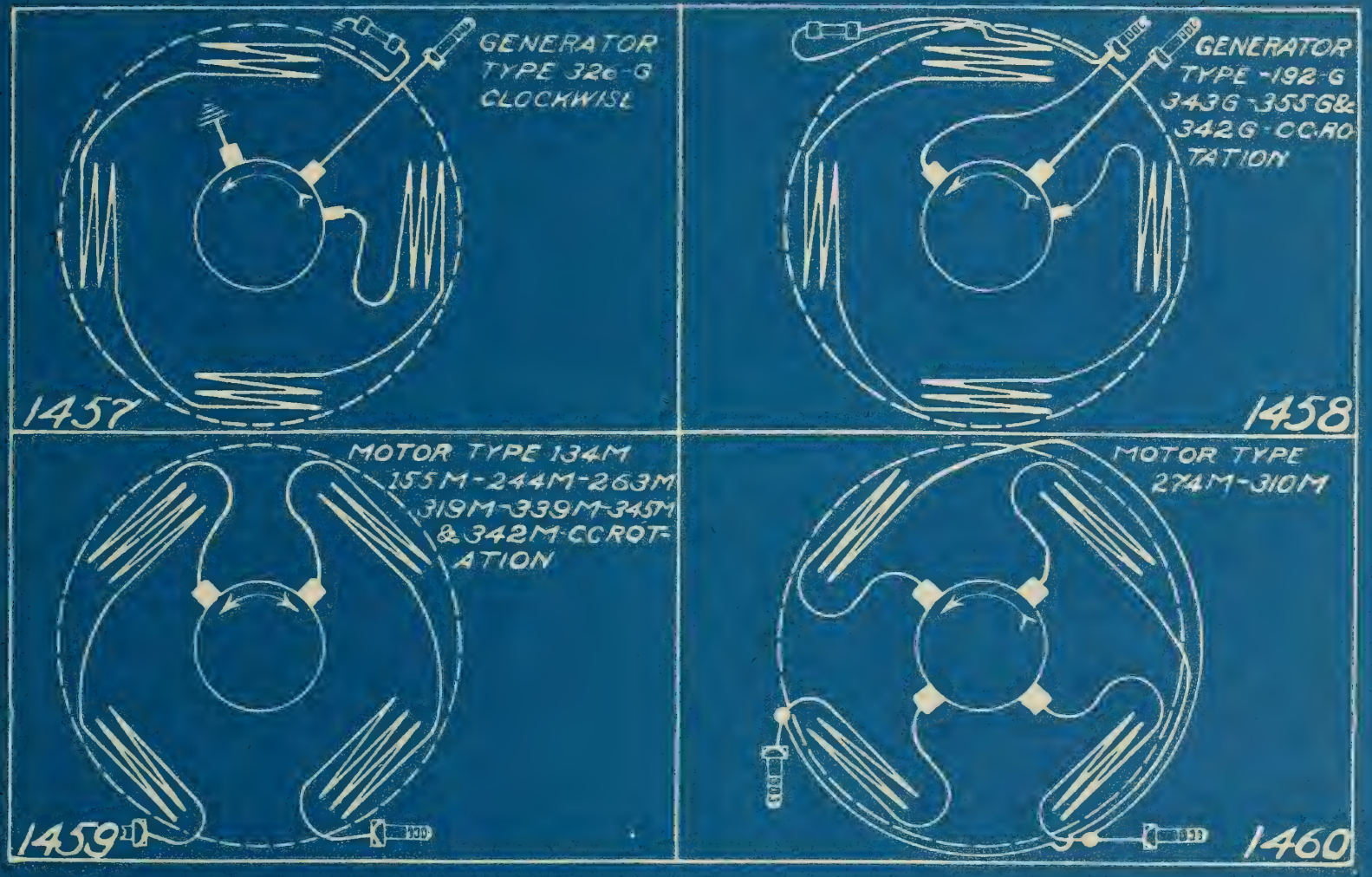
LEECE-NEVILLE GENERATORS



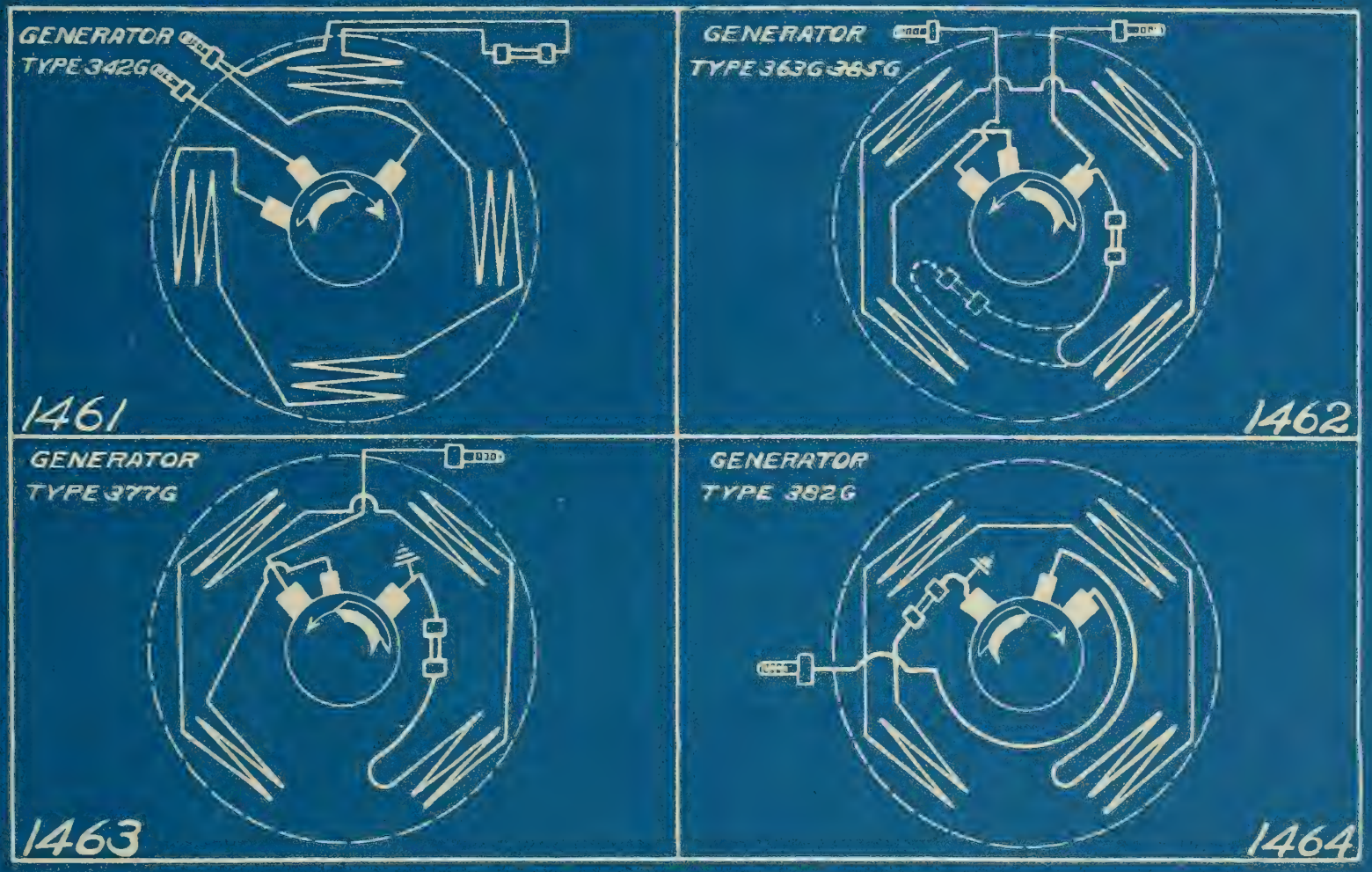
LEECE-NEVILLE INTERNAL CIRCUITS



LEECE-NEVILLE INTERNAL CIRCUITS

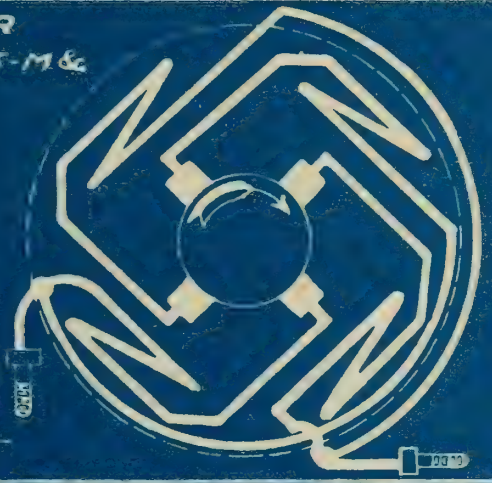


LEECE-NEVILLE INTERNAL CIRCUITS



LEECE-NEVILLE INTERNAL CIRCUITS

MOTOR
TYPE 275-M &
311-M



1465

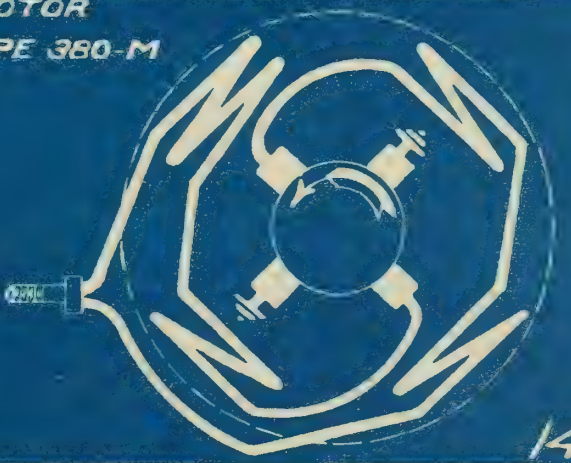
MOTOR
TYPE 375-M
391-M - 393-M

1466

MOTOR
TYPE 388-M

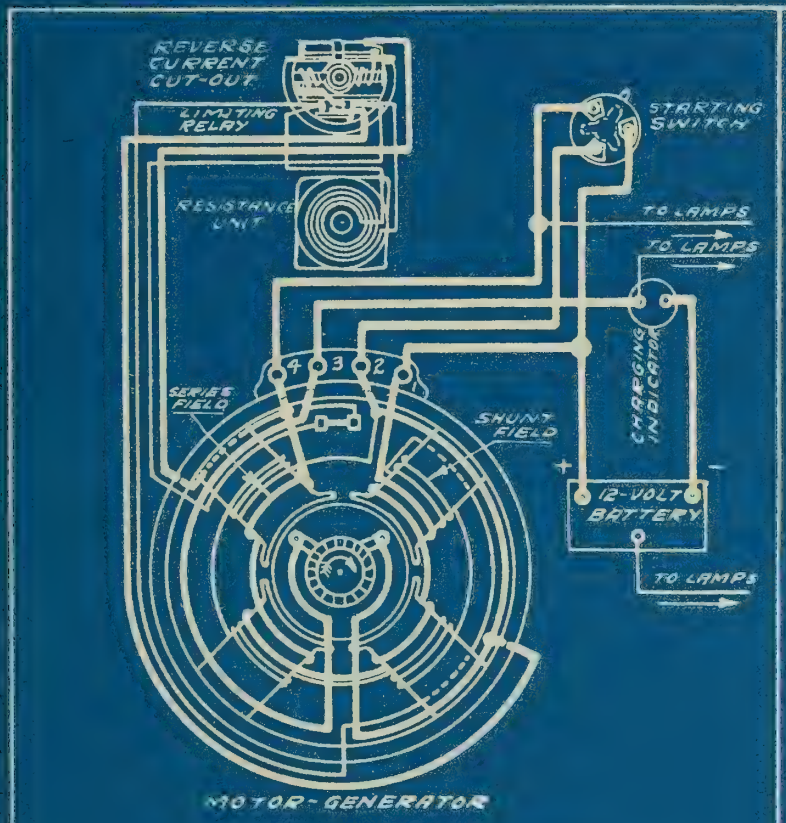
1467

MOTOR
TYPE 380-M



1468

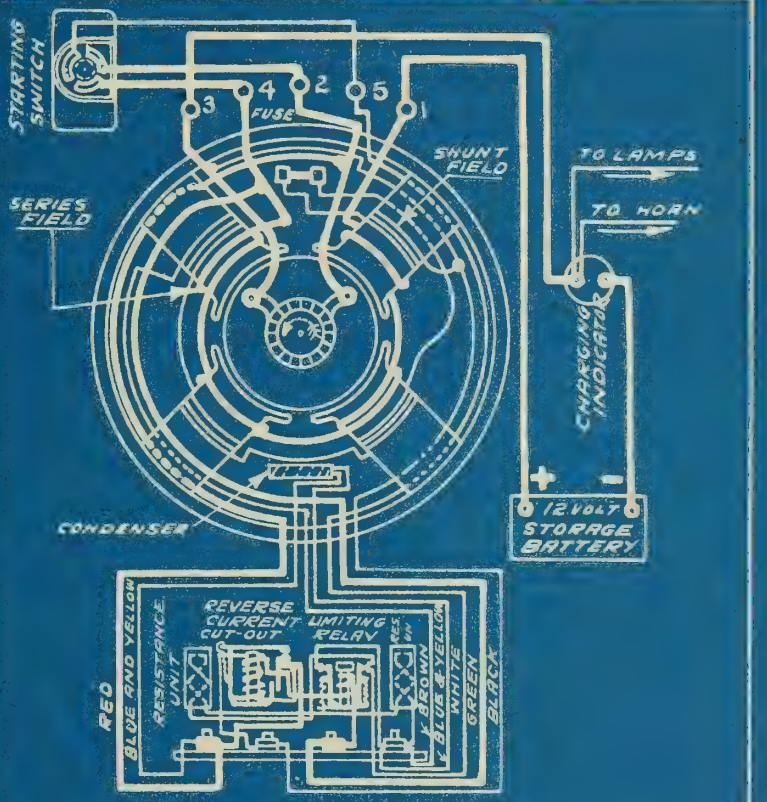
NORTH EAST INTERNAL CIRCUITS



MODEL-A-SYSTEM

POLARIZED RELAY TYPE MOTOR-GENERATOR

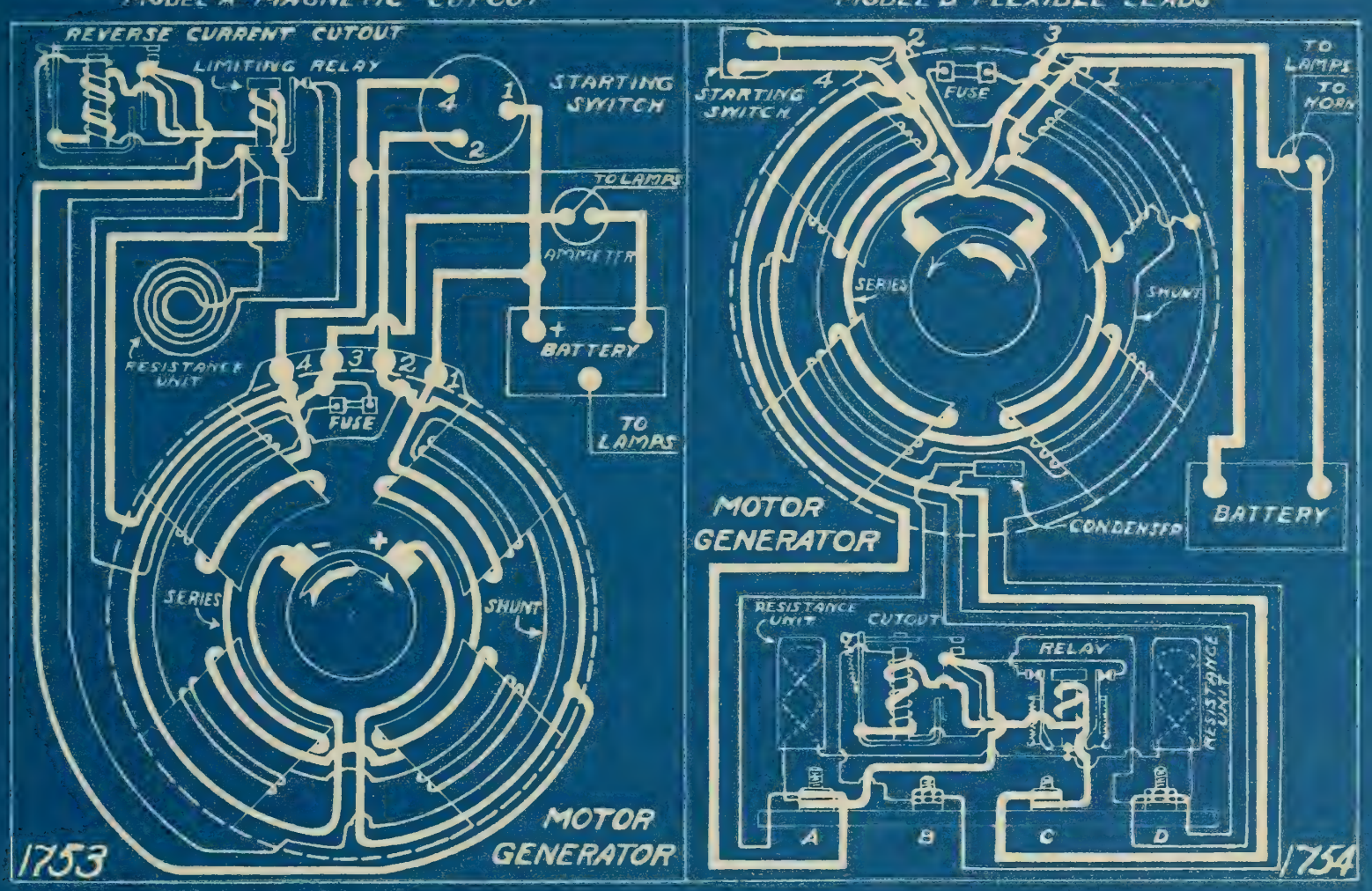
1751



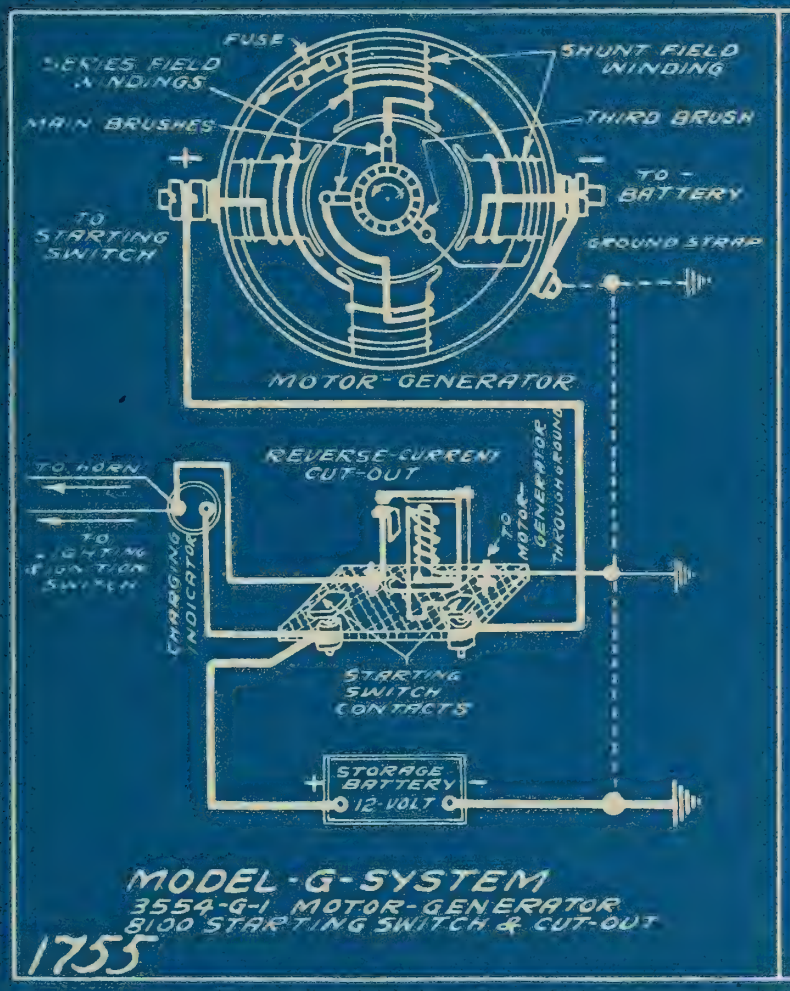
MODEL-B-SYSTEM

1752

NORTH EAST INTERNAL CIRCUITS



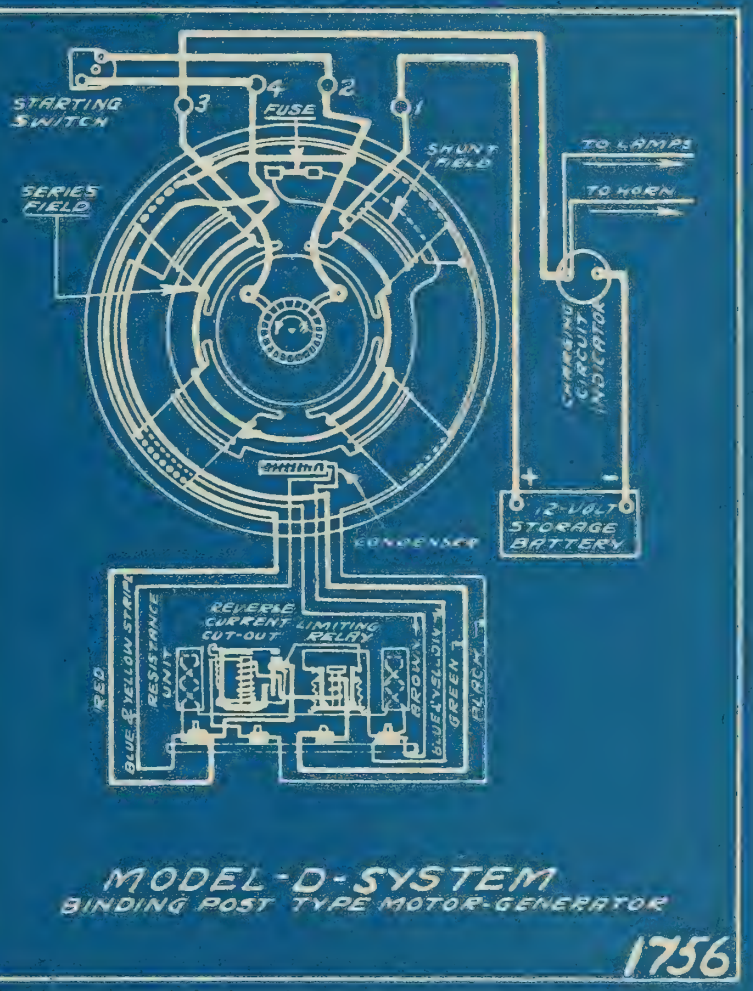
NORTH EAST INTERNAL CIRCUITS



MODEL-G-SYSTEM

3554-G-1 MOTOR-GENERATOR
8100 STARTING SWITCH & CUT-OUT

1755

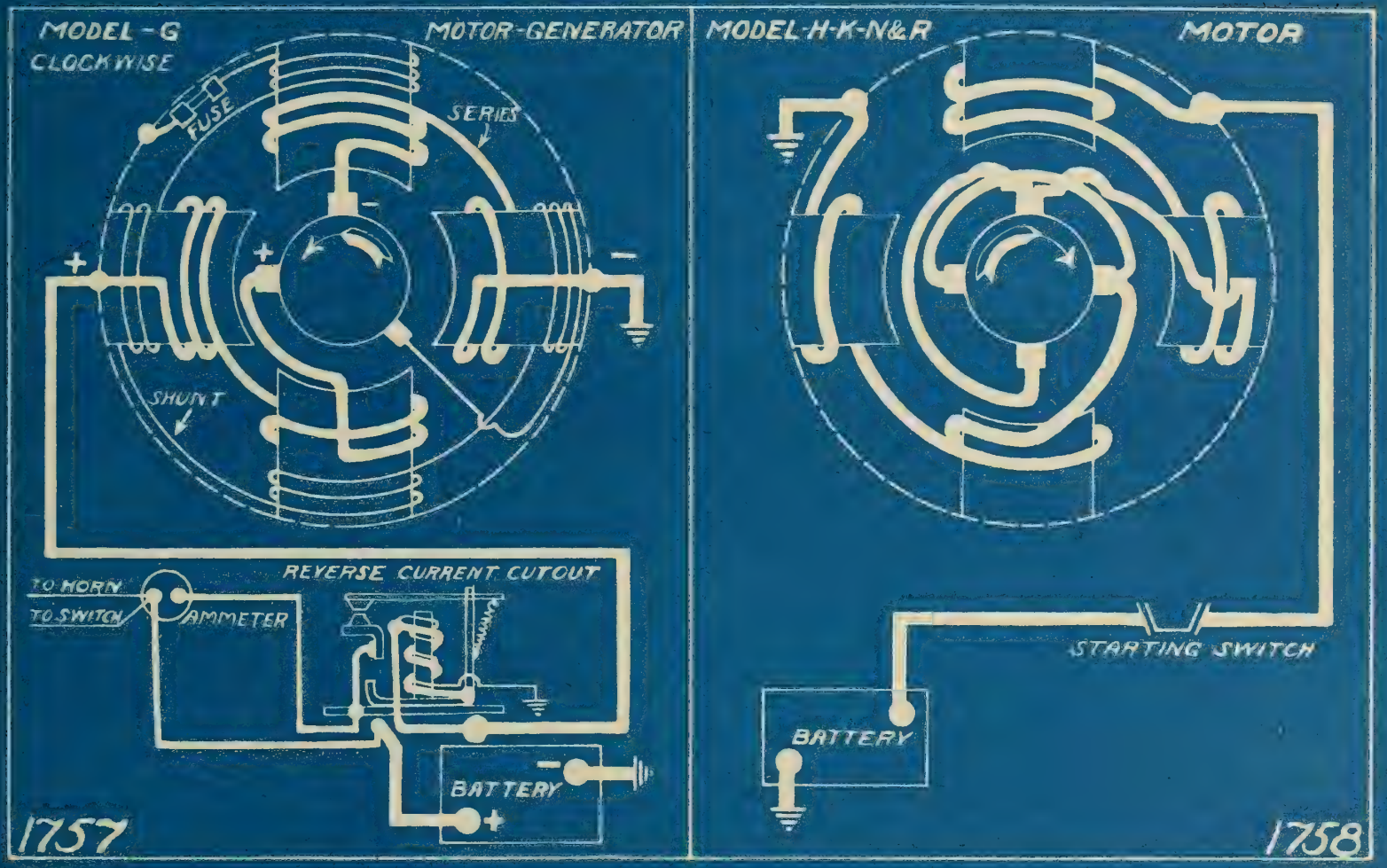


MODEL-D-SYSTEM

BINDING POST TYPE MOTOR-GENERATOR

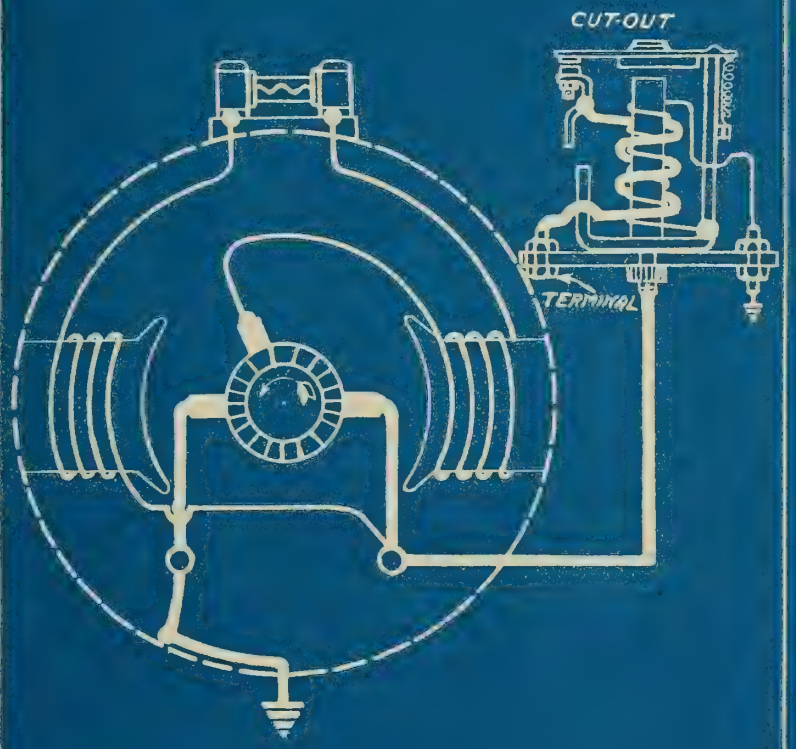
1756

NORTH EAST INTERNAL CIRCUITS



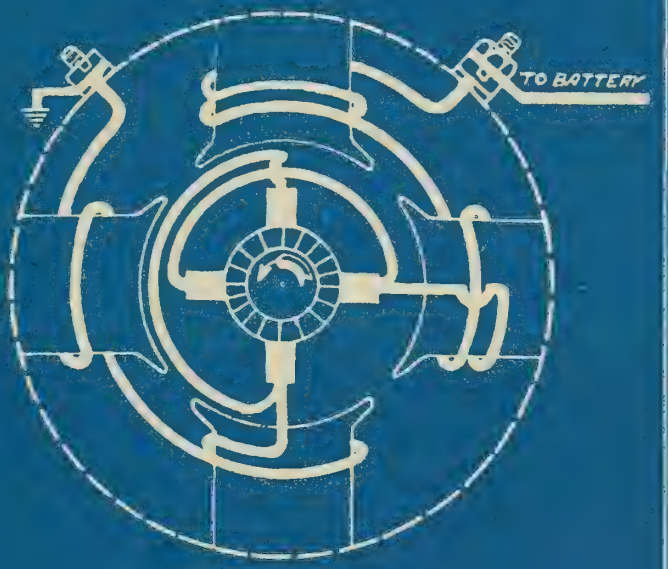
NORTH EAST INTERNAL CIRCUITS

L- GENERATOR



1759

H,K,N,&R MOTOR

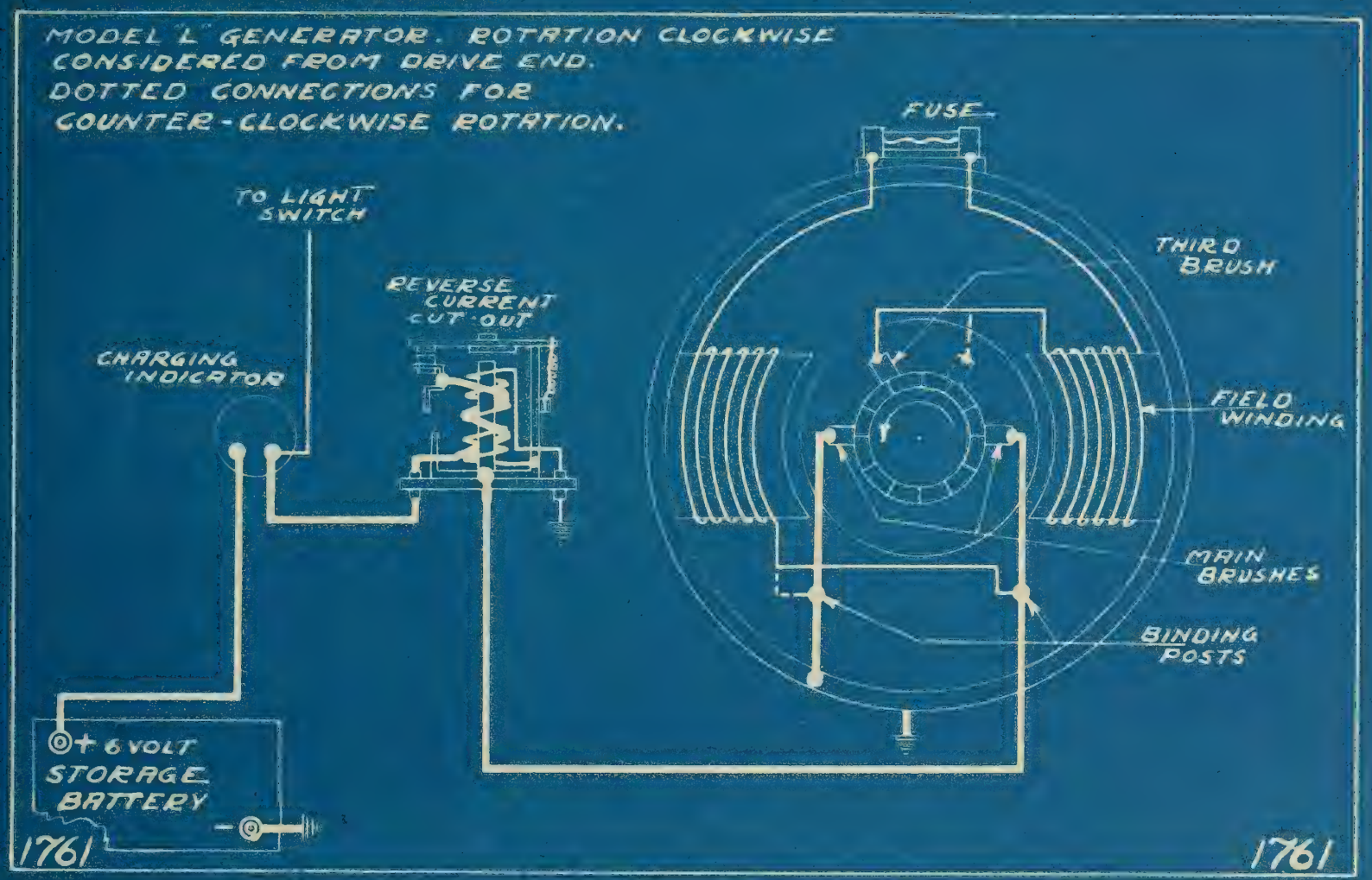


1760

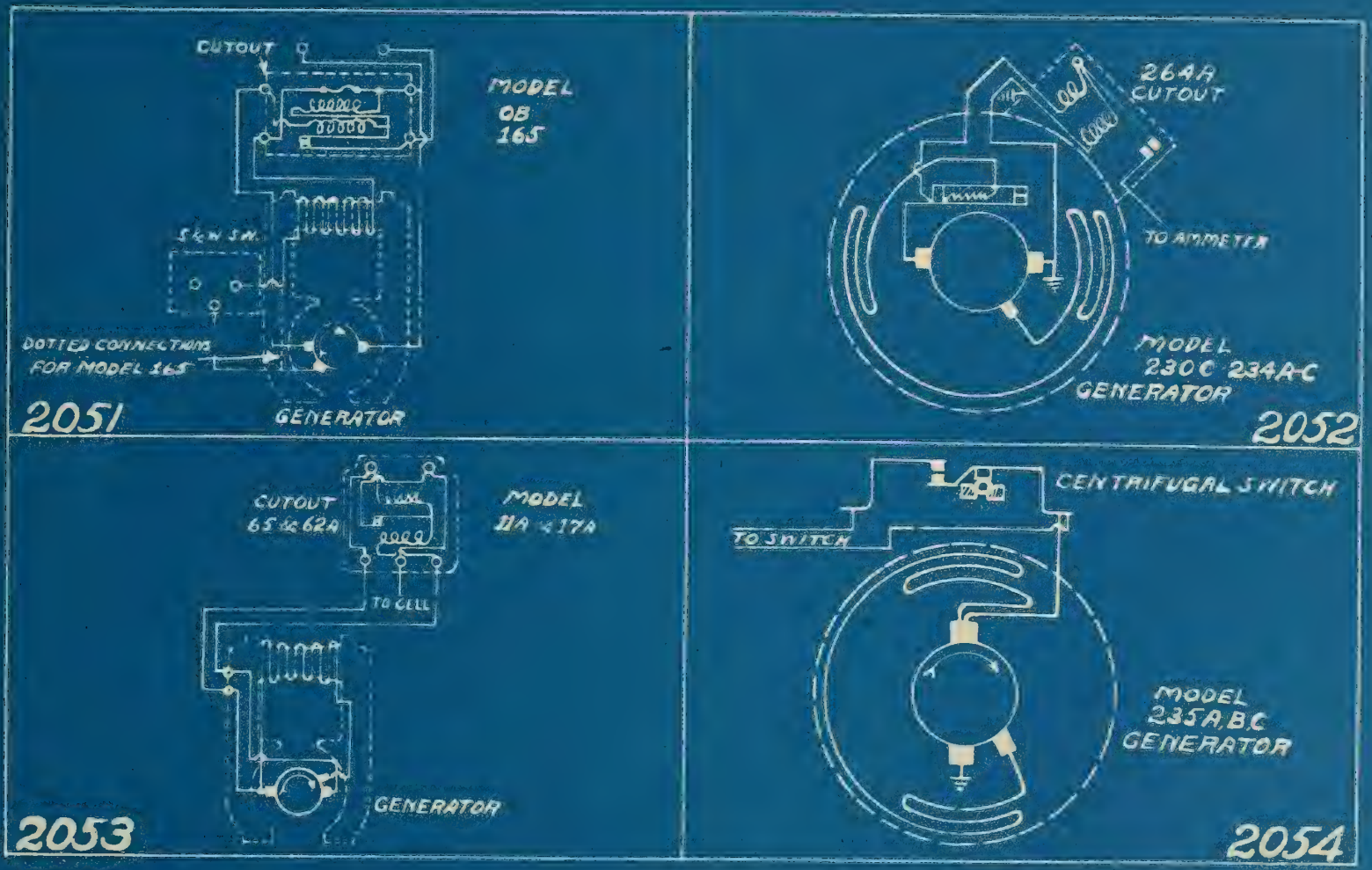
NORTH EAST INTERNAL CIRCUIT

GROUND RETURN SYSTEM

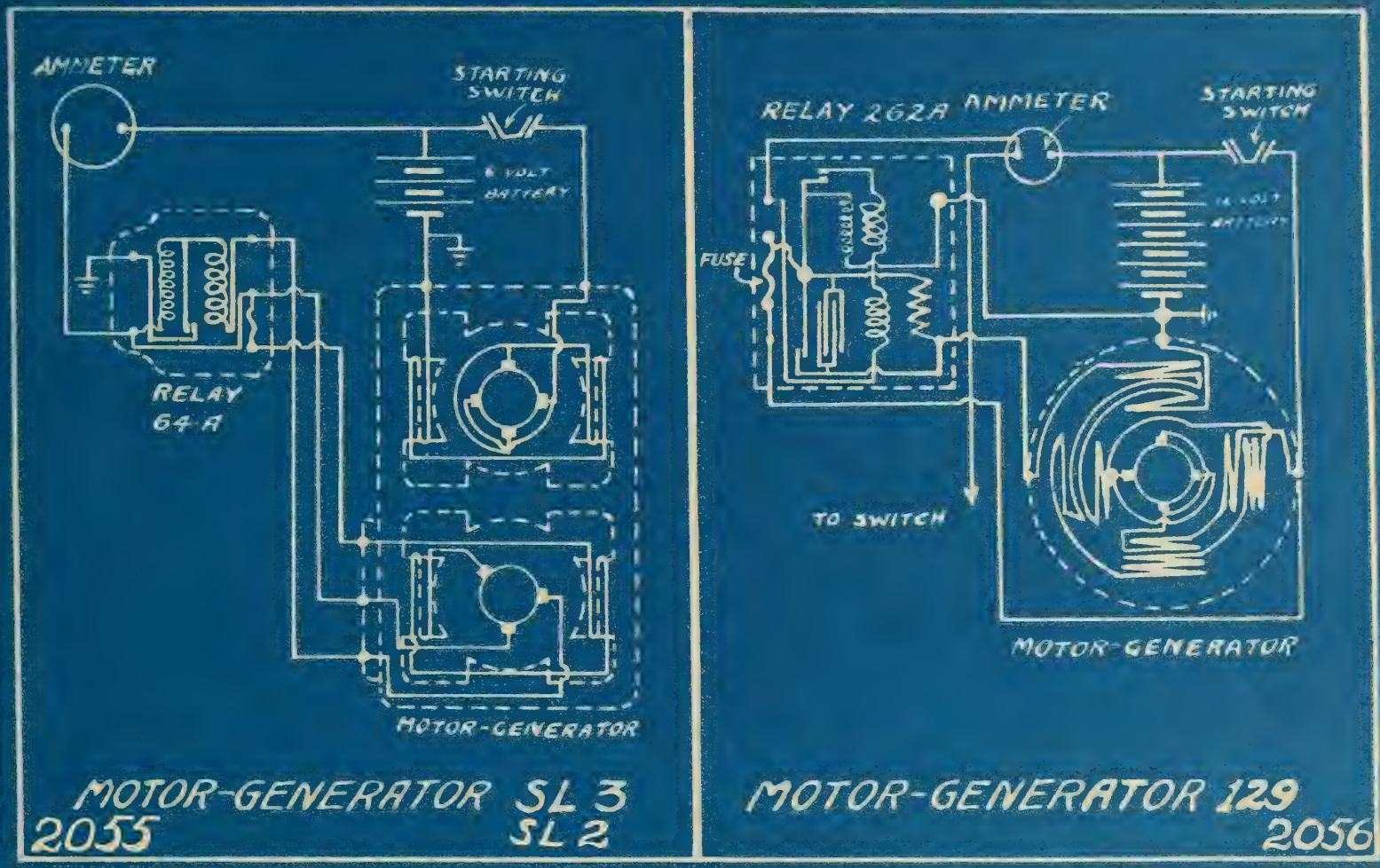
MODEL L GENERATOR. ROTATION CLOCKWISE CONSIDERED FROM DRIVE END.
DOTTED CONNECTIONS FOR COUNTER-CLOCKWISE ROTATION.



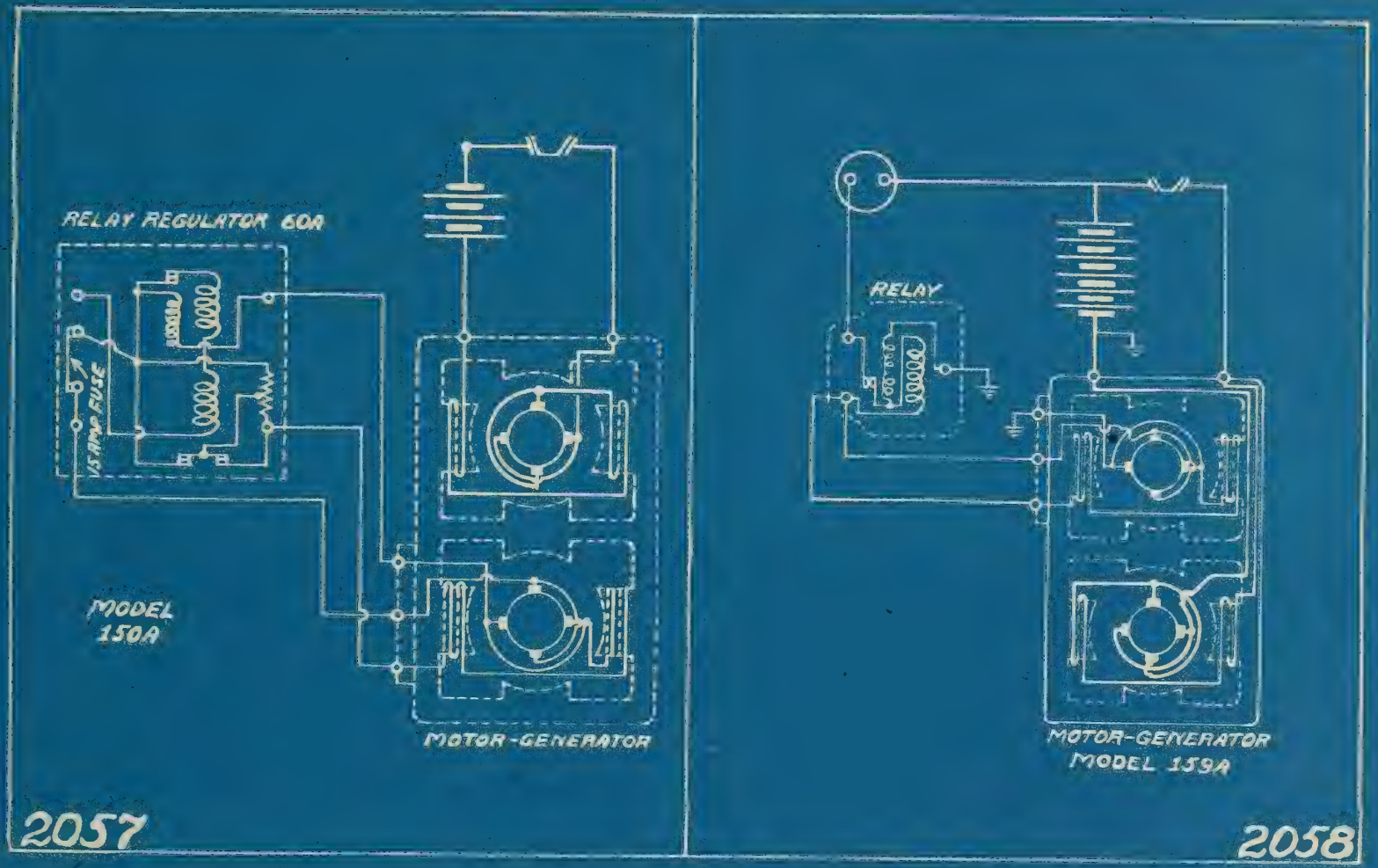
REMY INTERNAL CIRCUITS



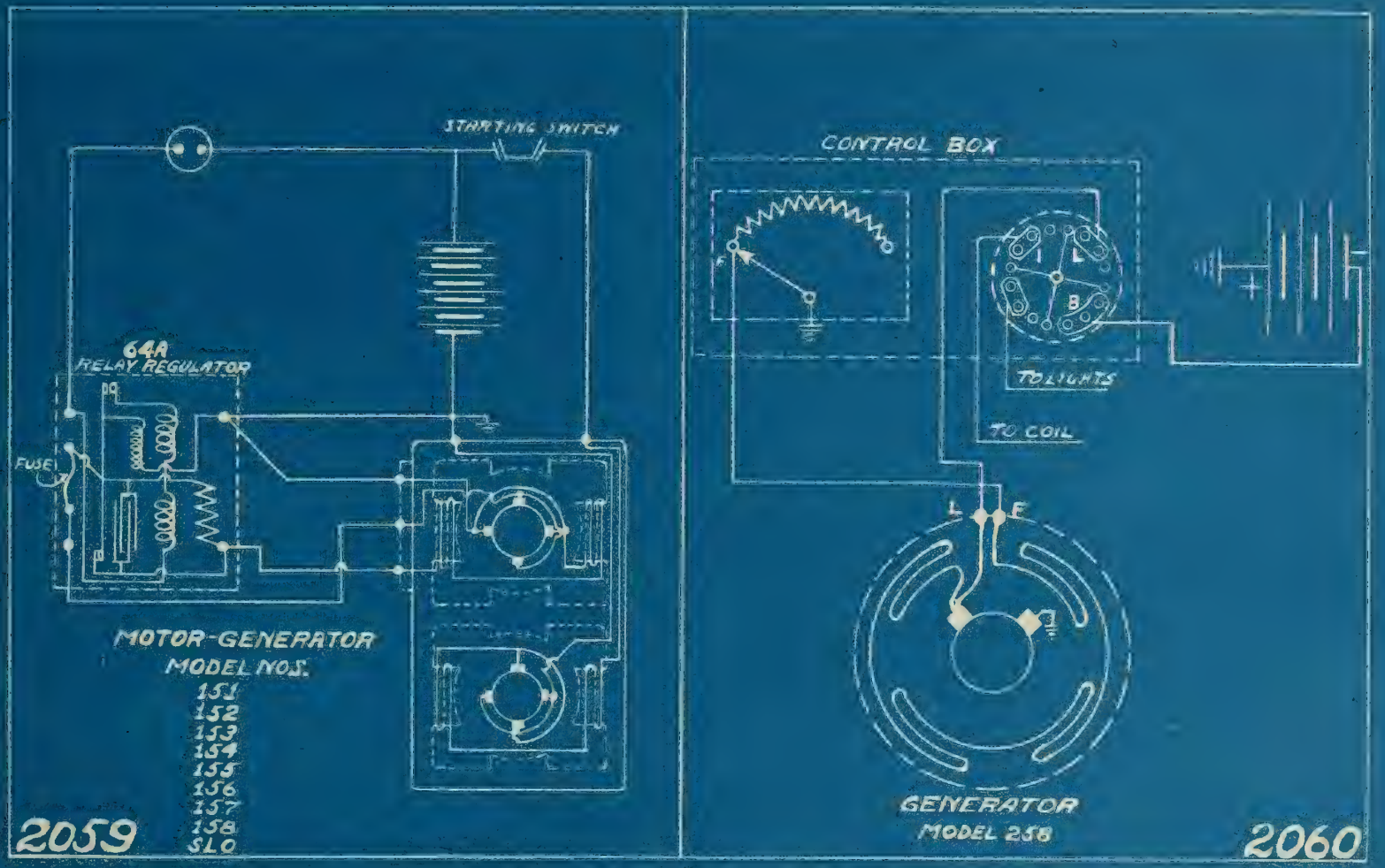
REMY INTERNAL CIRCUITS



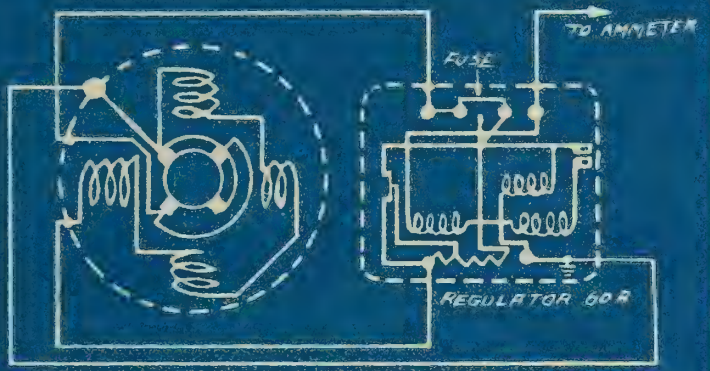
REMY INTERNAL CIRCUITS



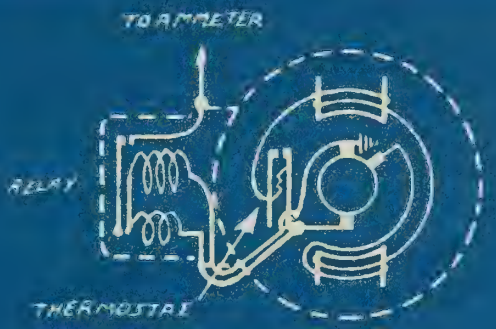
REMY INTERNAL CIRCUITS



REMY INTERNAL CIRCUITS



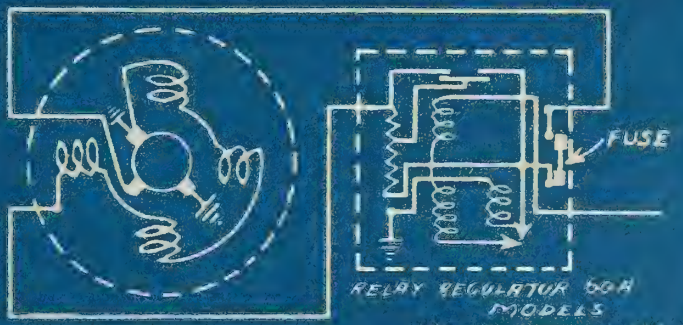
2061 GENERATOR No 16C



GENERATOR 231-232-230B-234A-B 911-913 2062

MODELS
293B-294-298-303B
304-305-292-700
701-705A-736A-740C
290

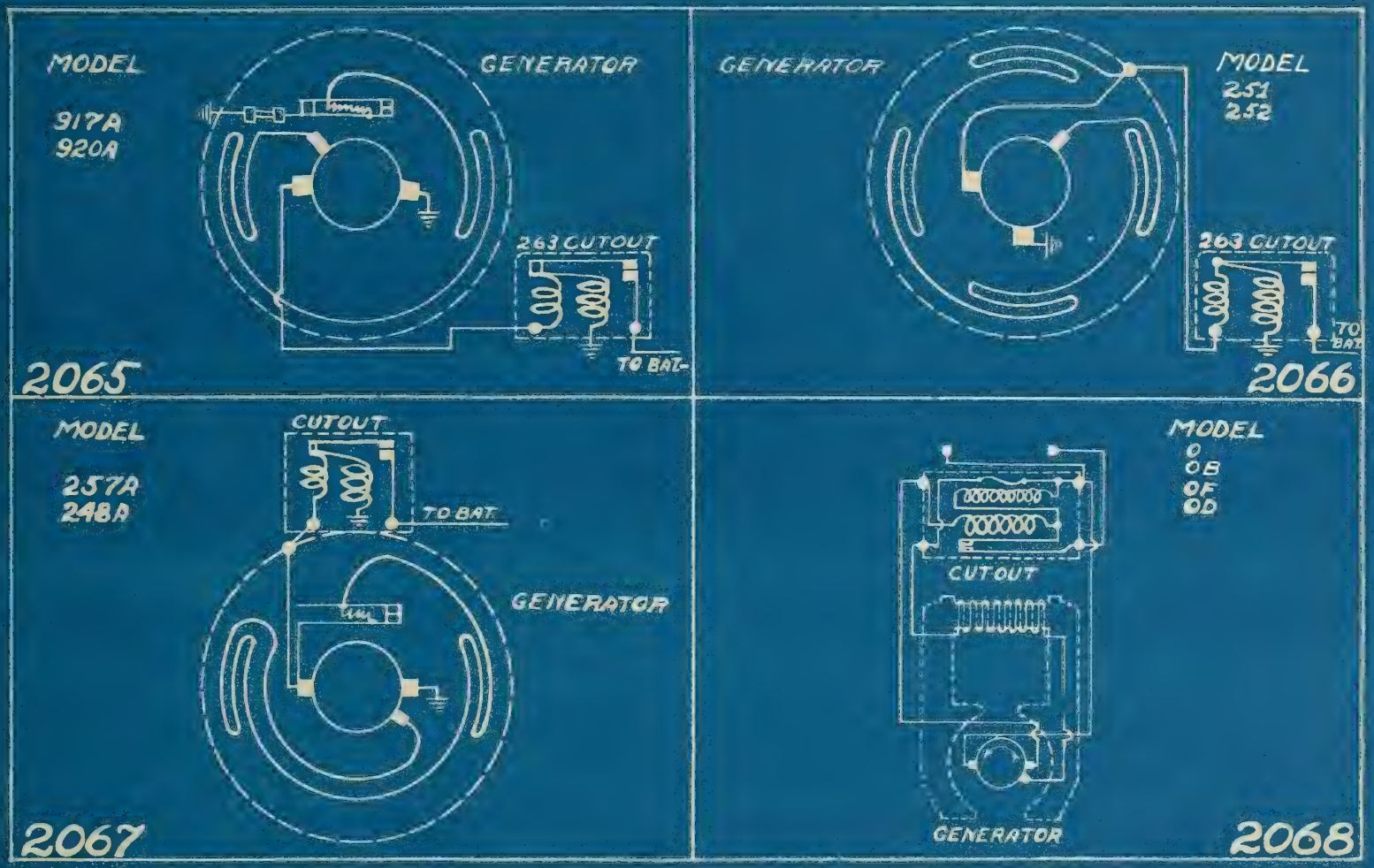
2063 STARTING MOTOR



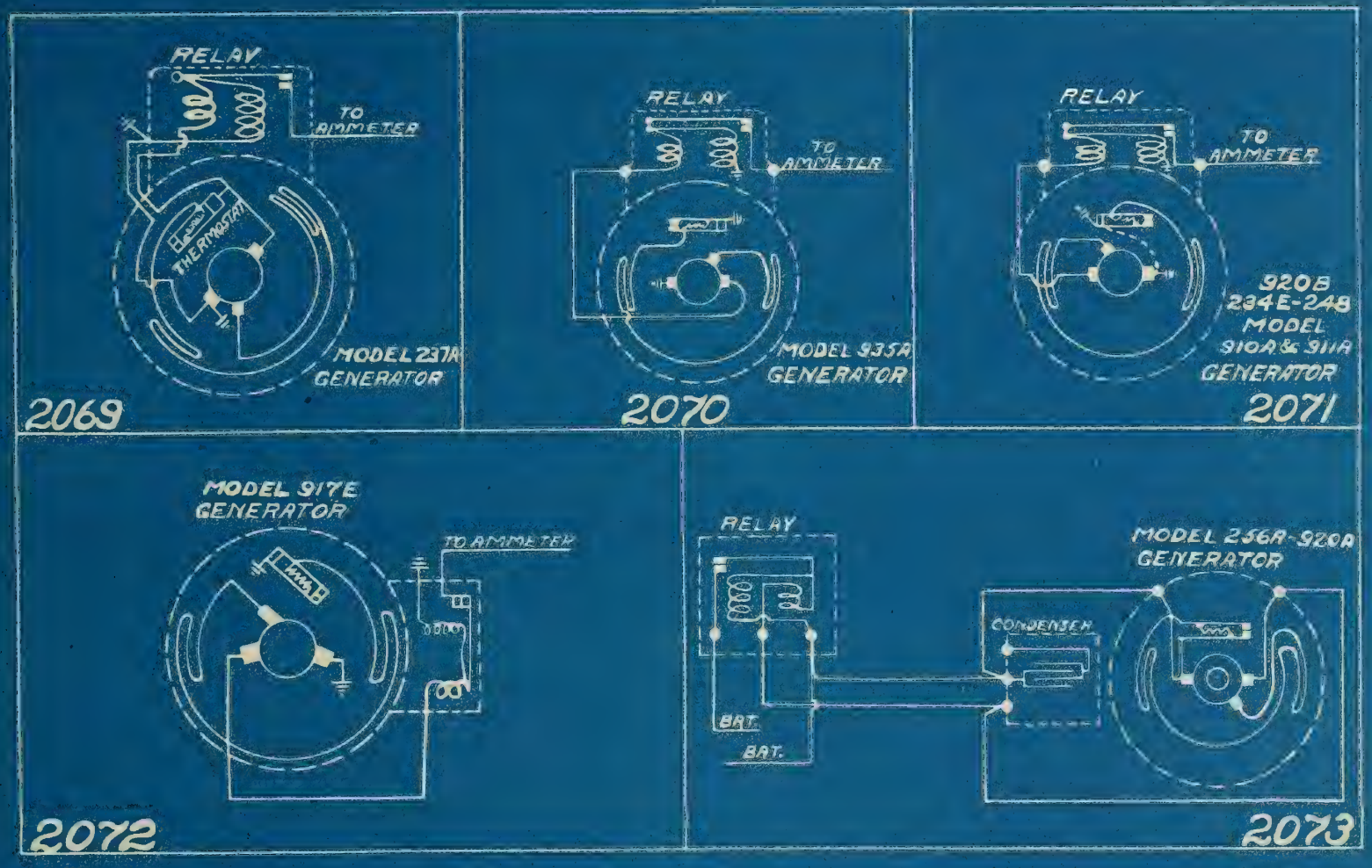
MODELS
16A-18-243-161-166-168
245-249-275-294-307

GENERATOR 2064

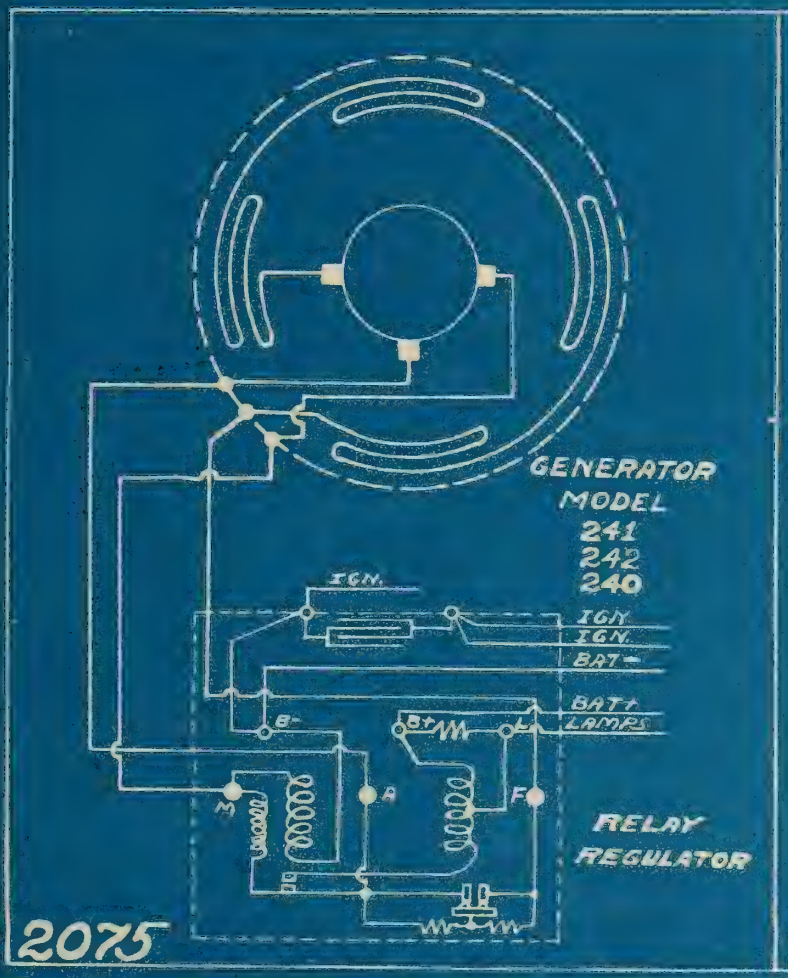
REMY INTERAL CIRCUITS

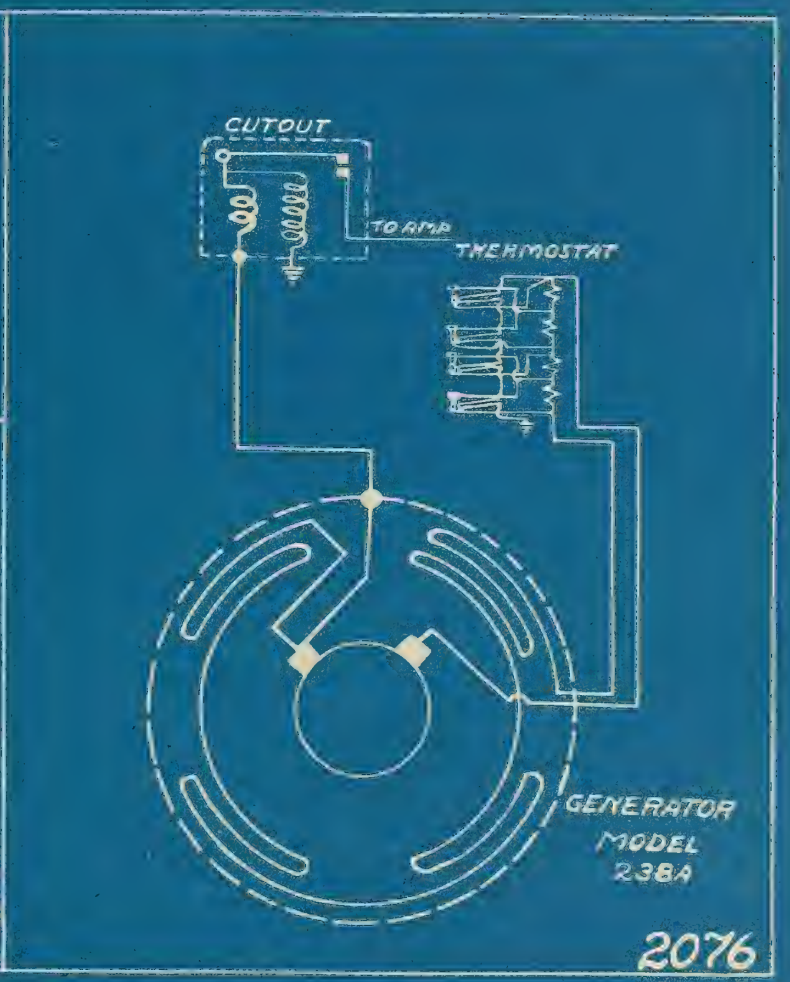


REMY INTERNAL CIRCUITS

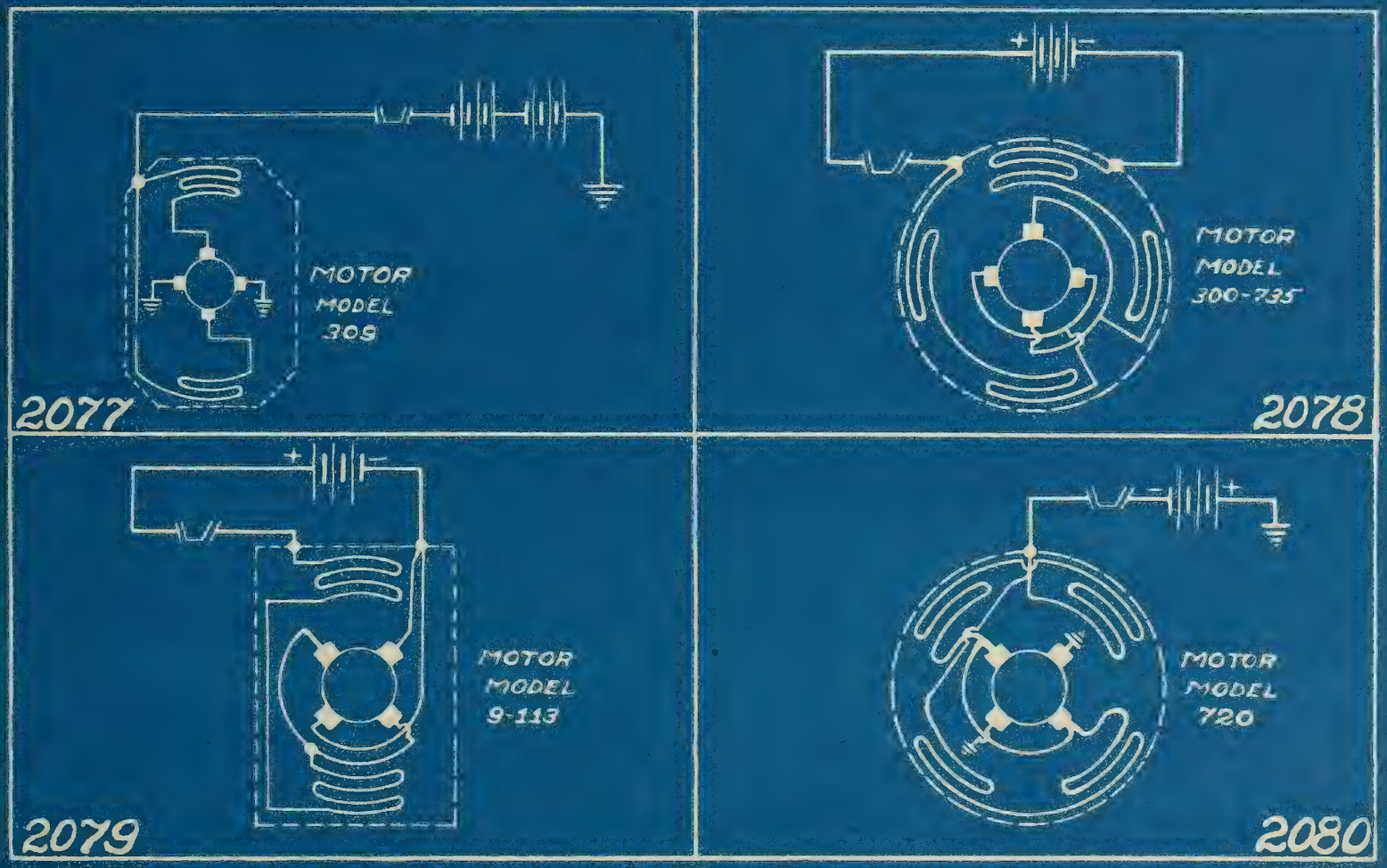


REMY INTERNAL CIRCUITS





REMY INTERNAL CIRCUITS

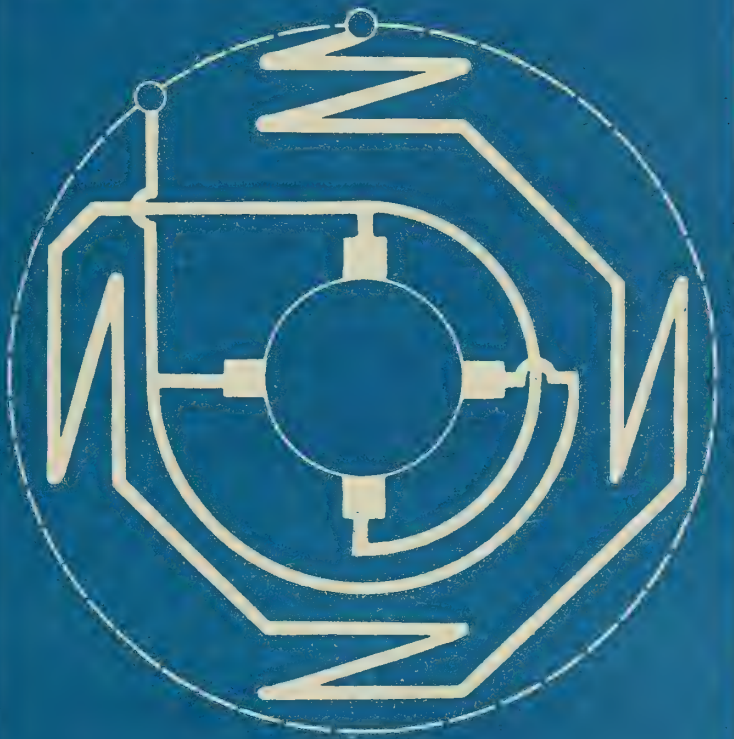


REMY INTERNAL CIRCUITS

MOTOR
NO. 114-117-180-182-186-293A-303A-C-307-701

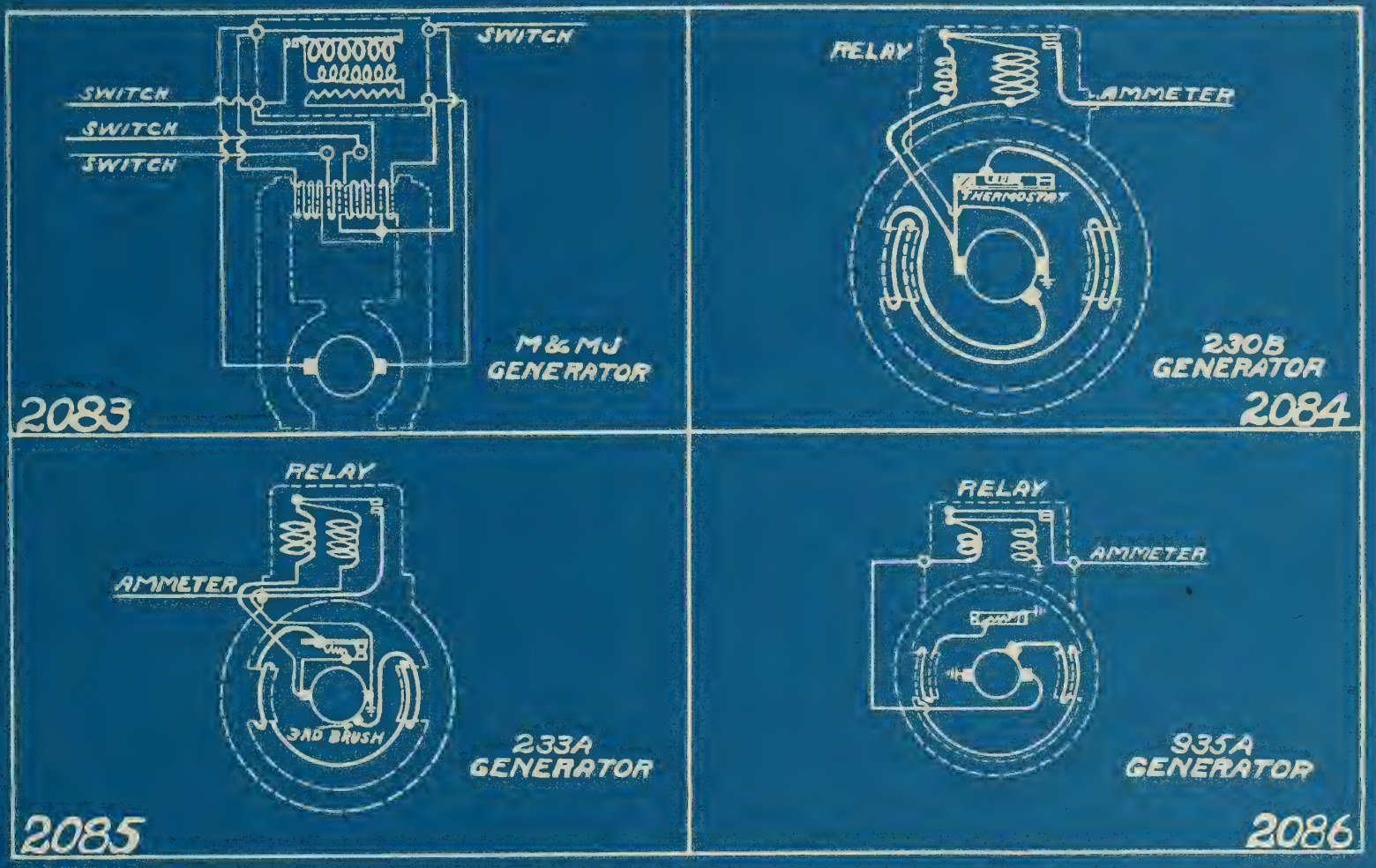
2081

MOTOR
NO. 4-5-6-185-188-189

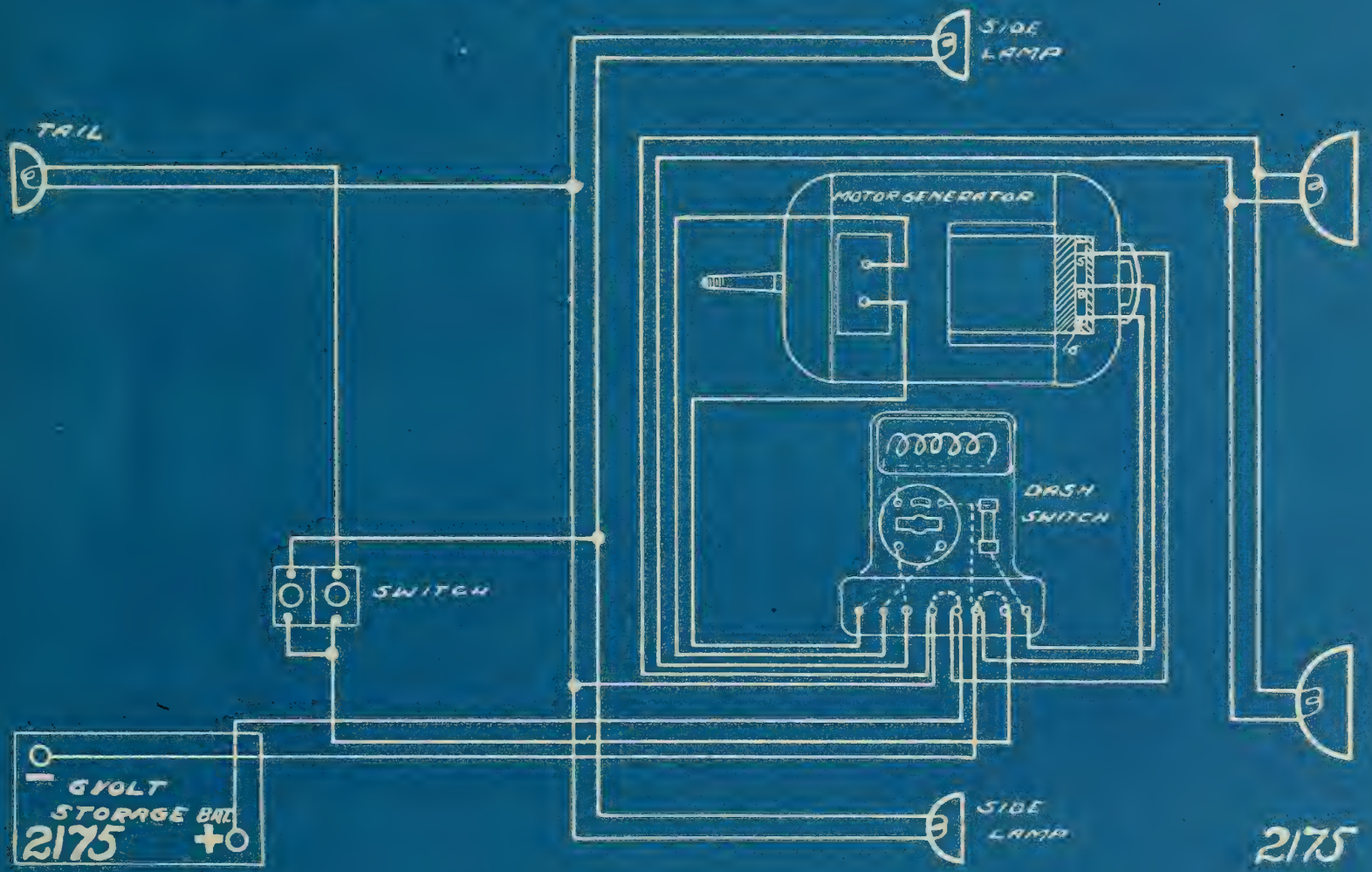


2082

REMY INTERNAL CIRCUITS

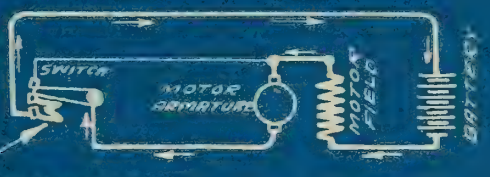


RUSHMORE STANDARD WIRING



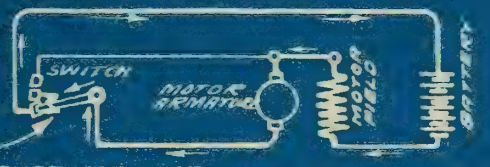
2175

RUSHMORE INTERNAL CIRCUITS



RESISTANCE USED FOR ENGAGING PINION IN FLY WHEEL GEAR.

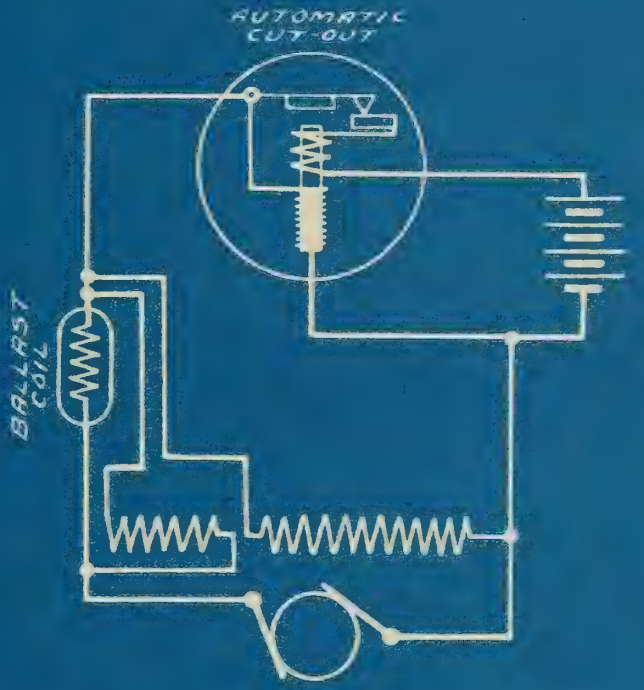
ELECTRICAL CIRCUIT DURING FIRST PART OF DOWNWARD MOVEMENT OF SWITCH PEDAL



RESISTANCE USED FOR ENGAGING PINION IN FLY WHEEL GEAR.

ELECTRICAL CIRCUIT ESTABLISHED WHEN SWITCH PEDAL HAS COMPLETED ITS DOWN-MOVEMENT.

2177

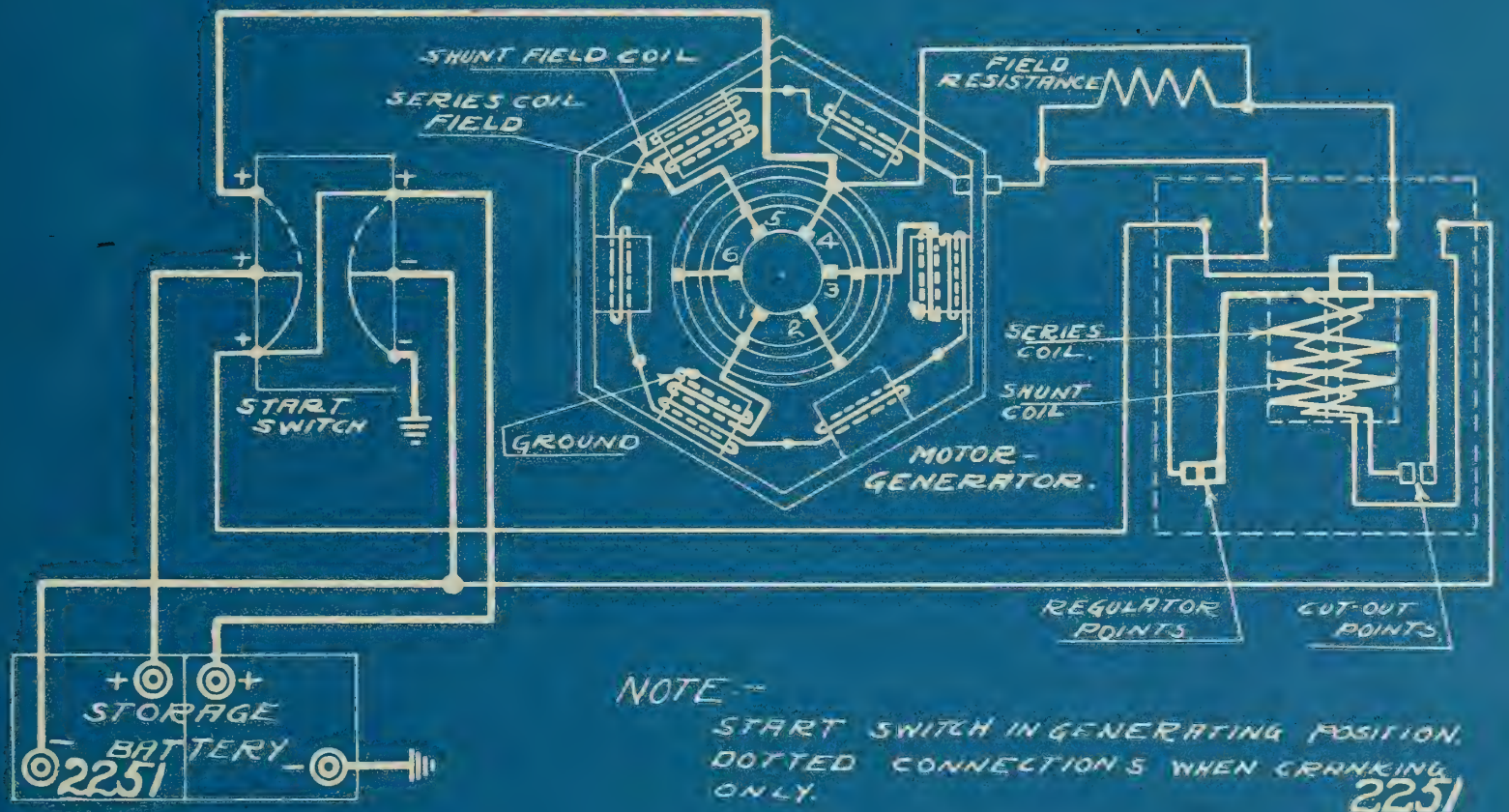


BOSCH-RUSHMORE GENERATOR
-BALLAST CONTROL-

2178

SIMMS-HUFF INTERNAL CIRCUITS

TYPE HK



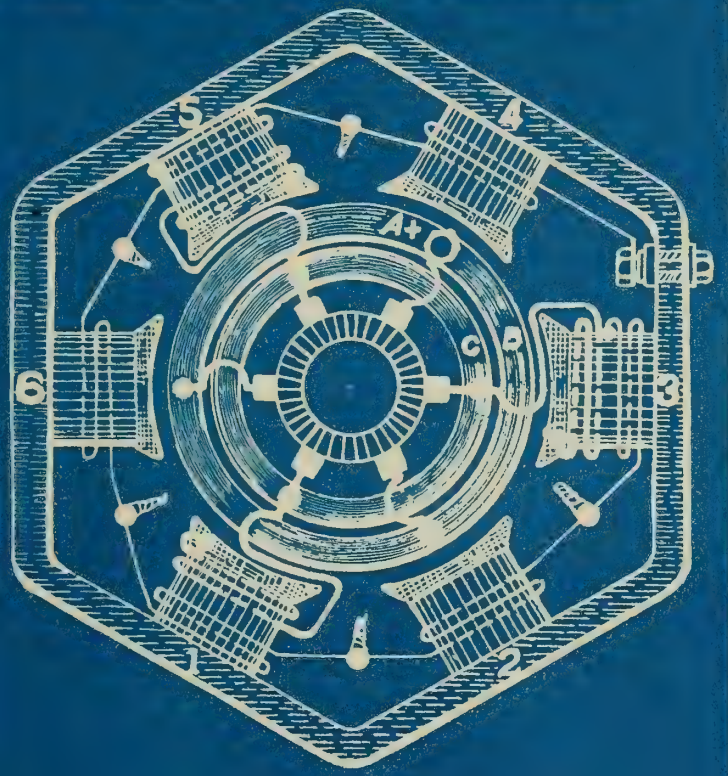
NOTE -

START SWITCH IN GENERATING POSITION.
DOTTED CONNECTIONS WHEN CRANKING ONLY.

2251

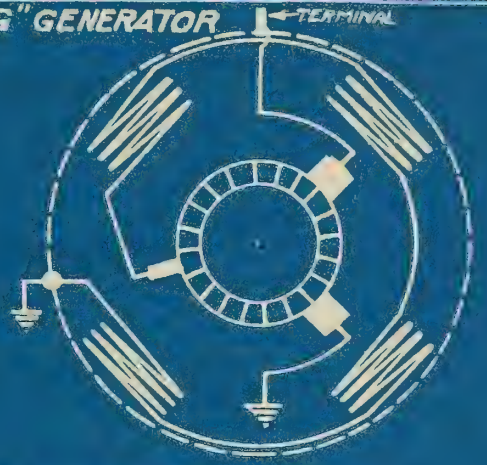
SIMMS-HUFF INTERNAL CIRCUITS

TYPES HK-HB-HM MOTOR-GENERATORS

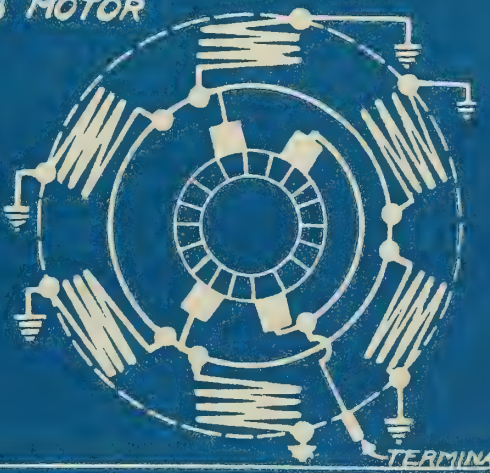


2253

TYPE "G" GENERATOR

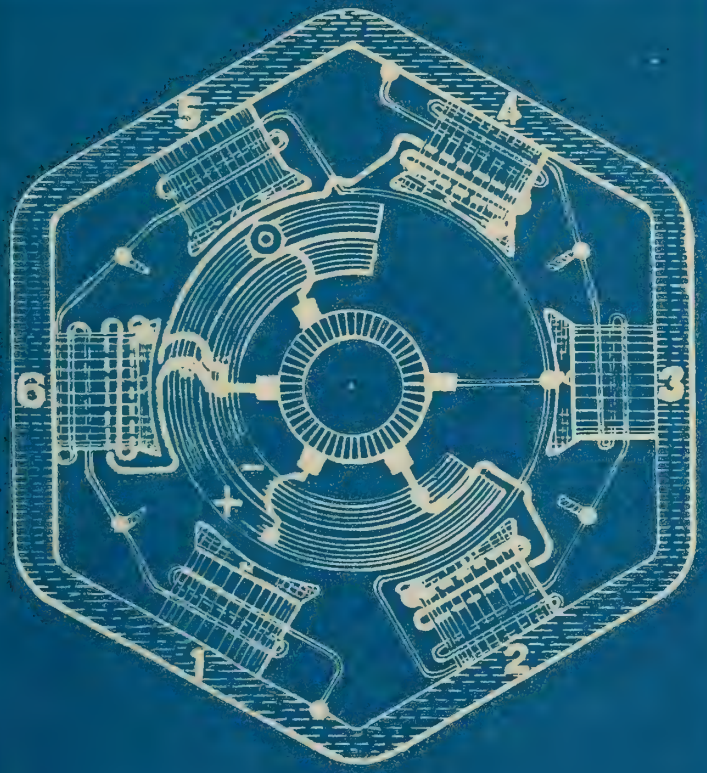


TYPE B MOTOR



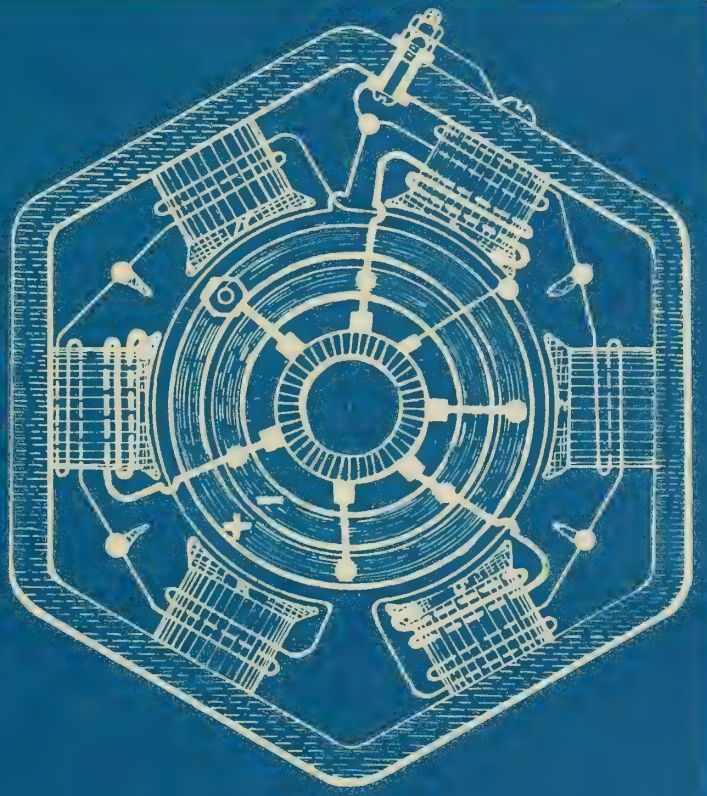
2254

SIMMS-HUFF MOTOR-GENERATORS



S.M.S.³ TYPE

2255

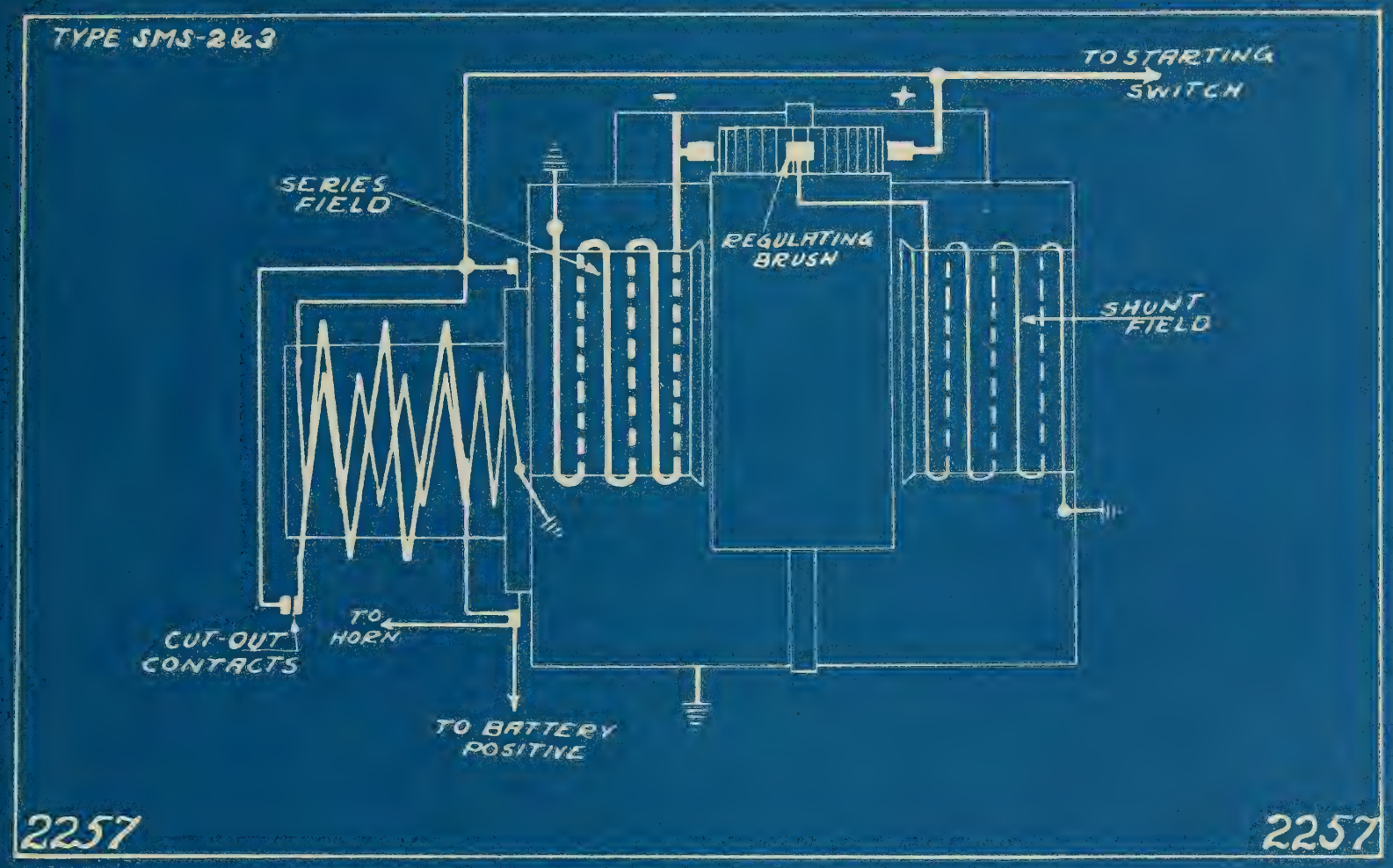


S.M.S 2 TYPE

2256

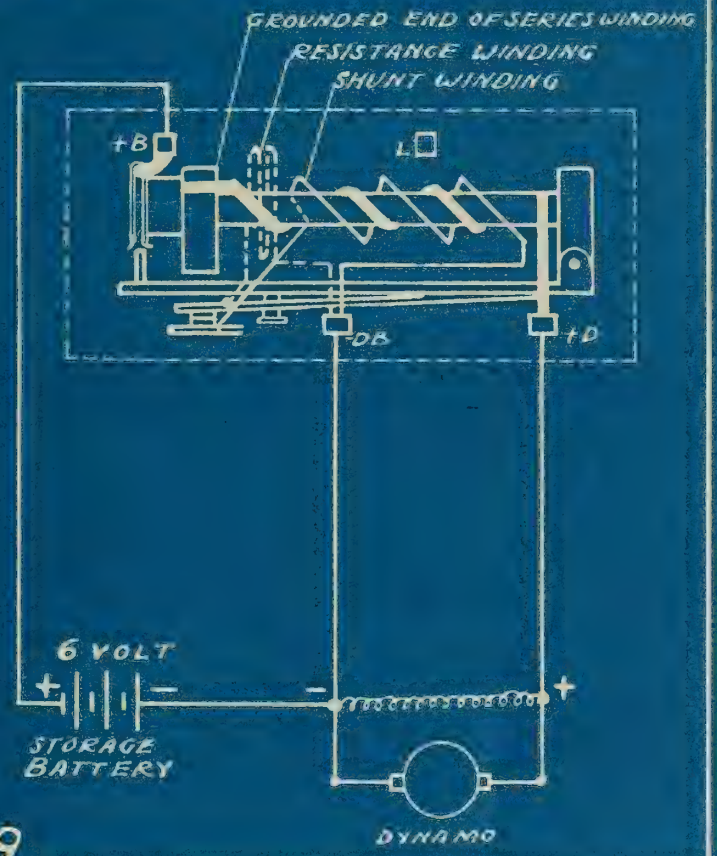
SIMMS-HUFF 12 VOLT MOTOR-GENERATOR

INTERNAL CIRCUIT



SPLITDORF-APELCO INTERNAL CIRCUITS

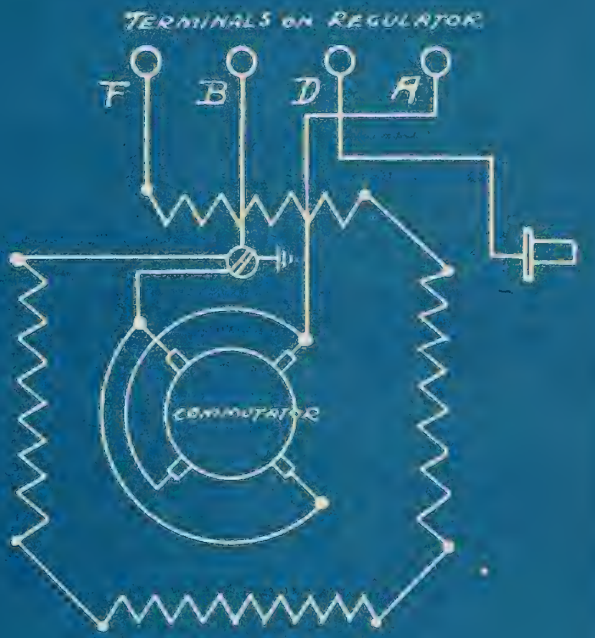
GENERATOR WITH CUT OUT



2359

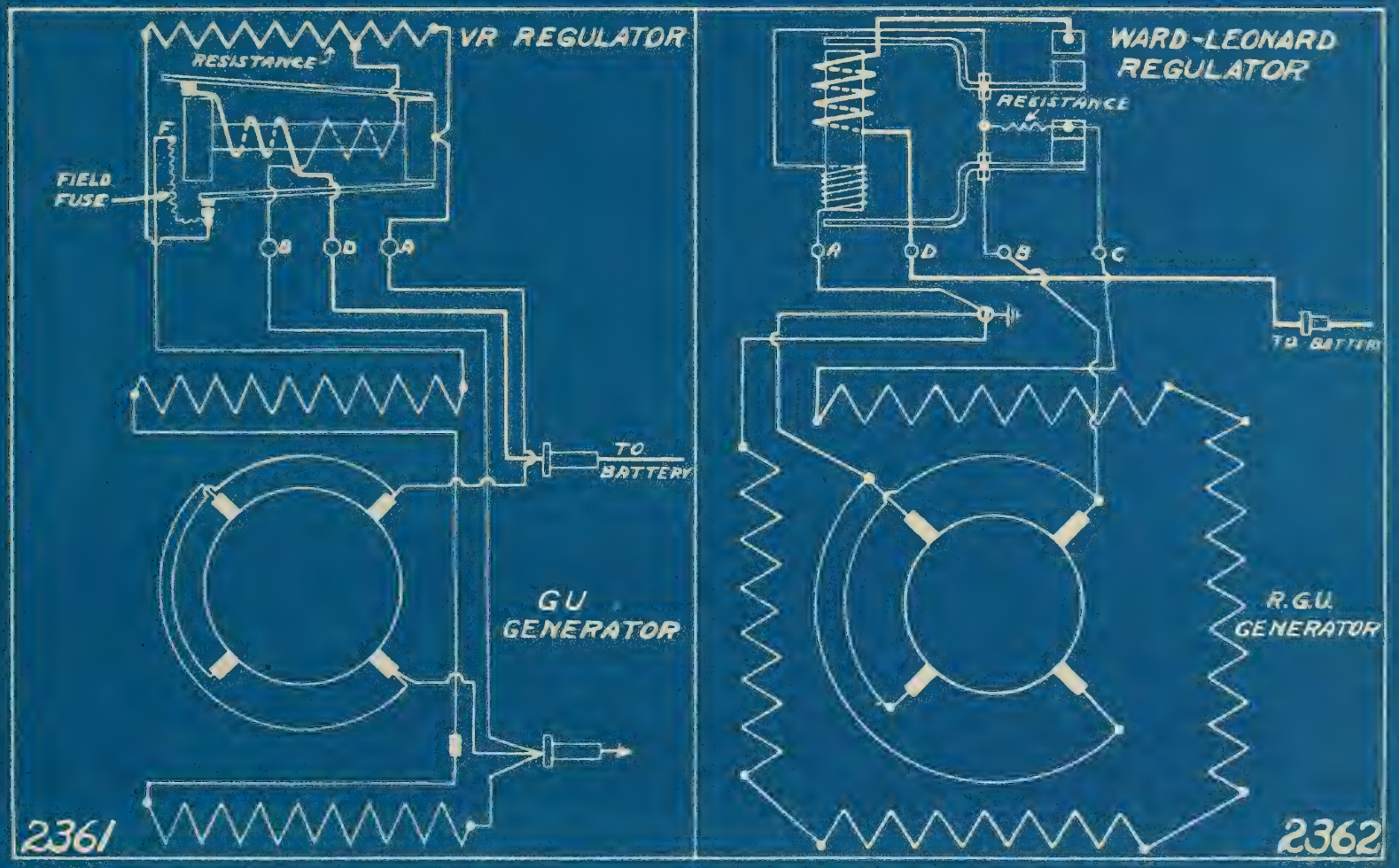
GENERATOR WITH REGULATOR CONNECTIONS

RGU GENERATOR FOR VR1 REGULATOR



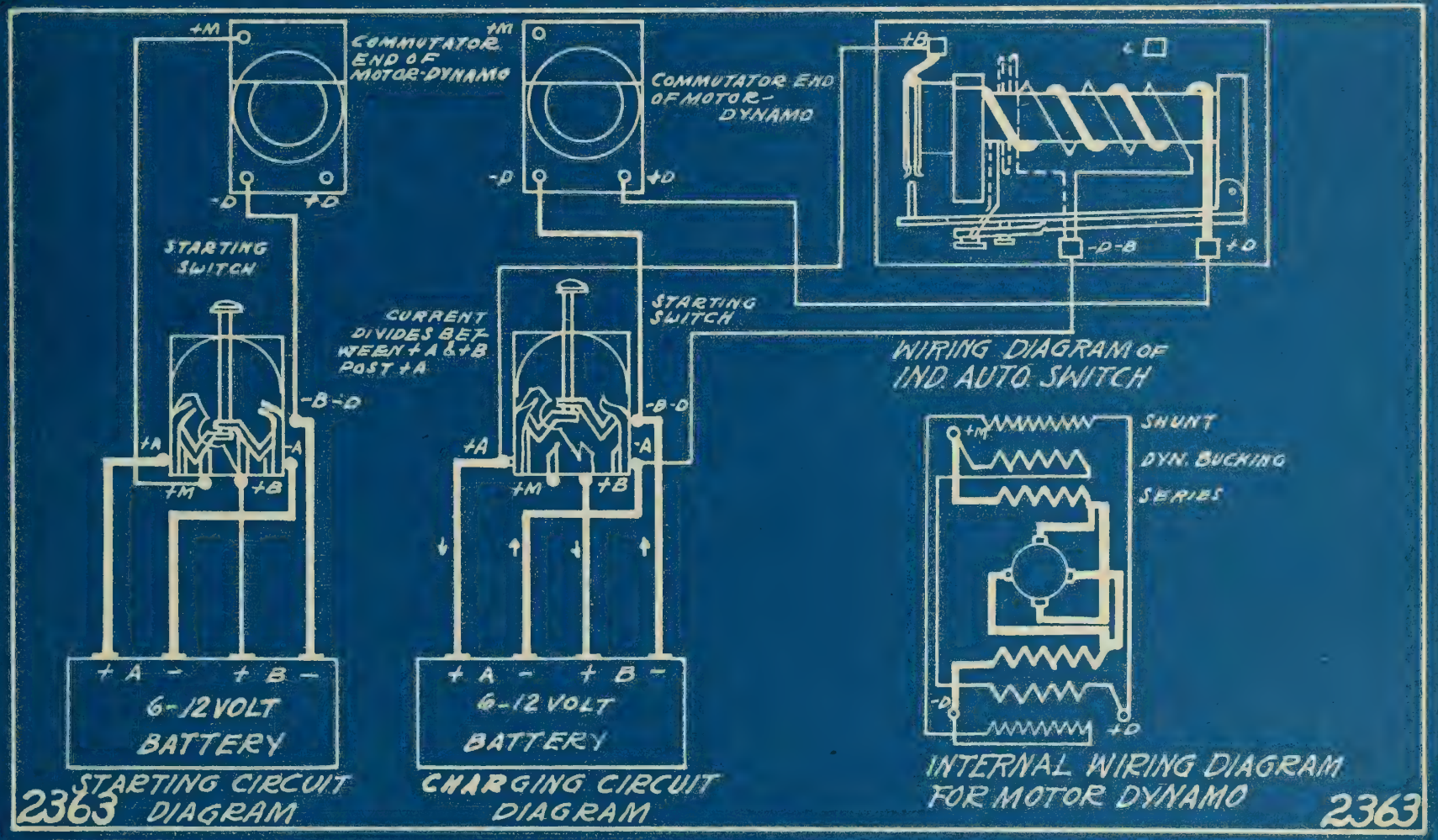
2360

SPLITDORF GENERATORS



SPLITDORF INTERNAL CIRCUITS

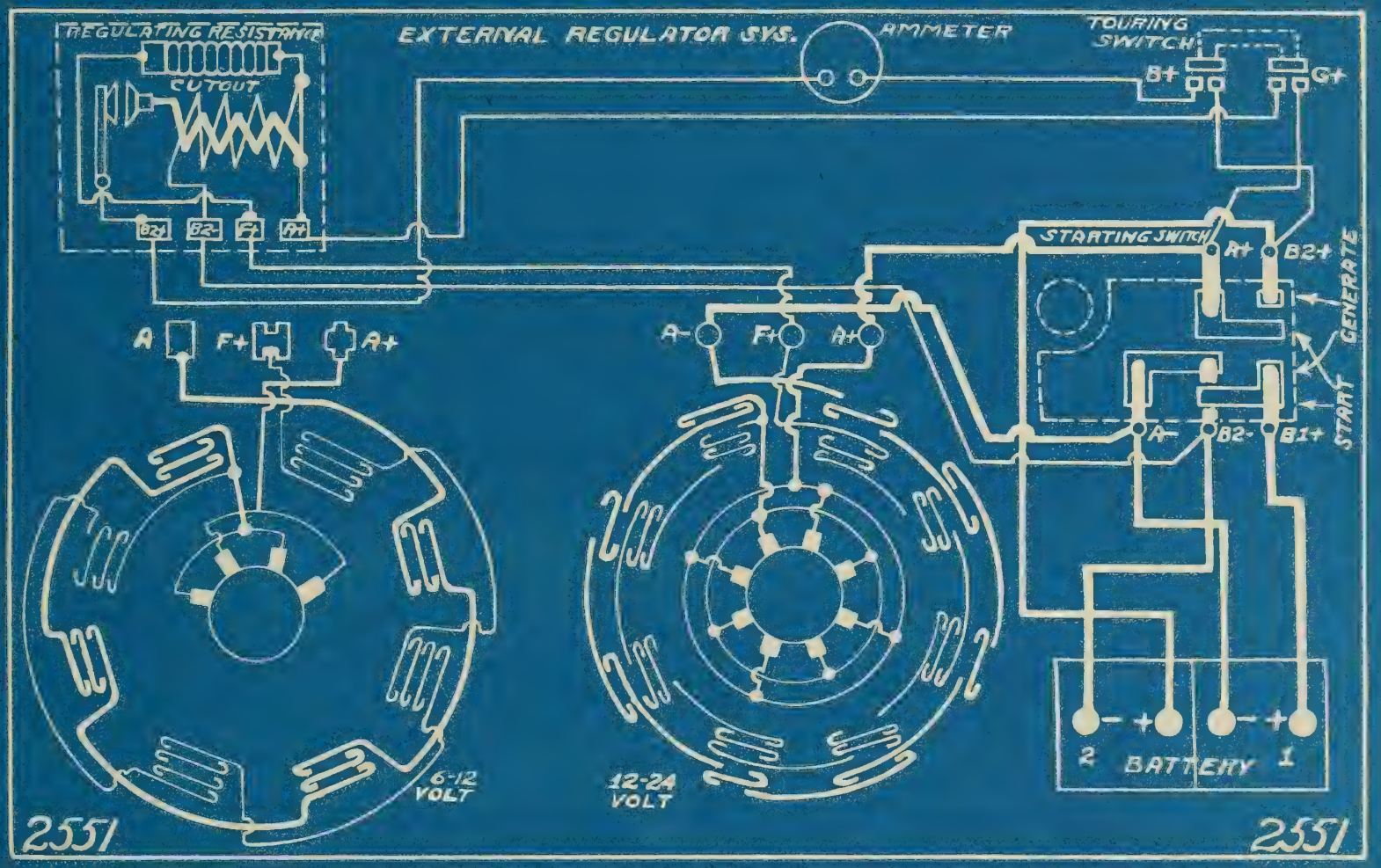
MOTOR-GENERATOR, SWITCH & CUT OUT



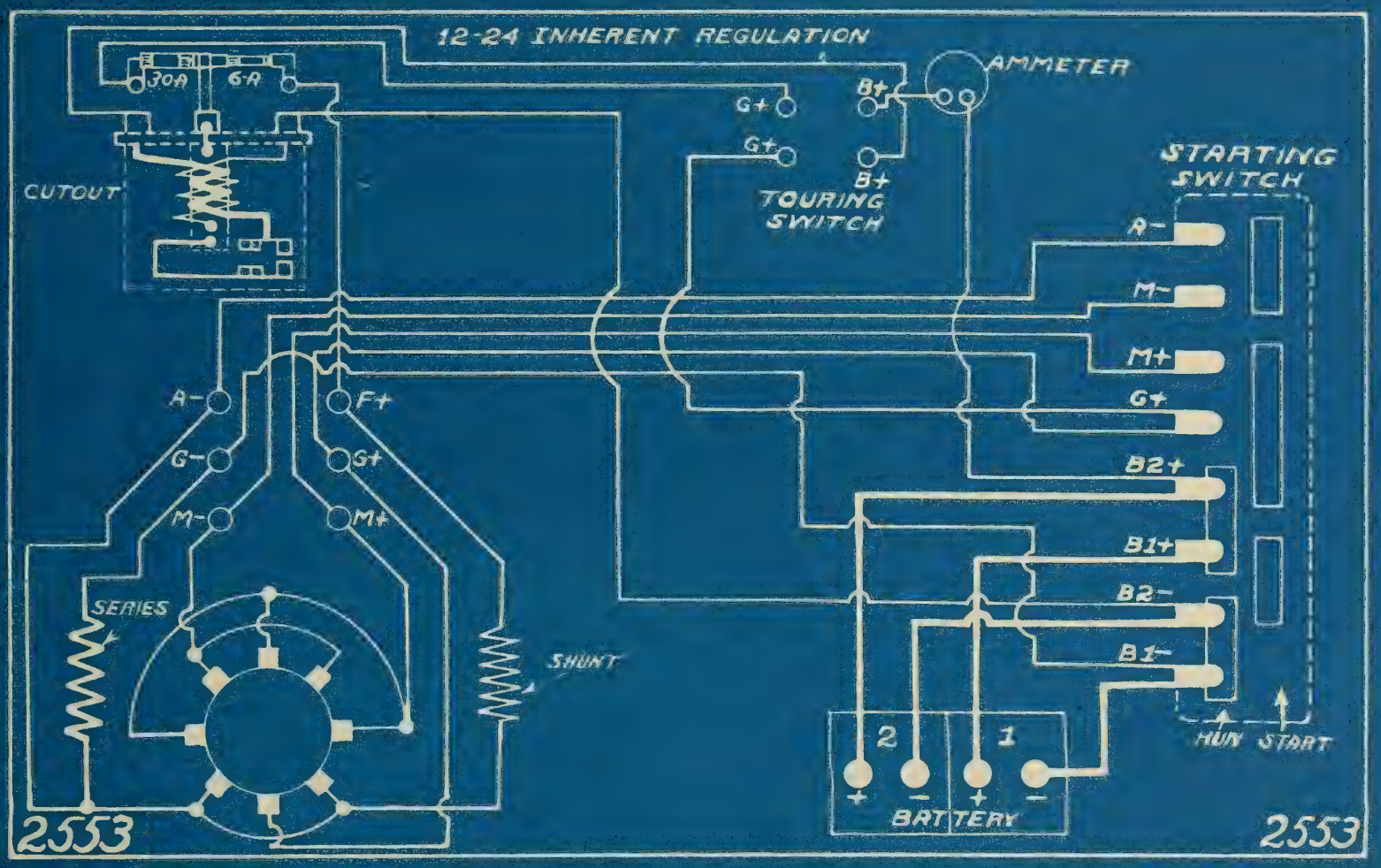
2363

2363

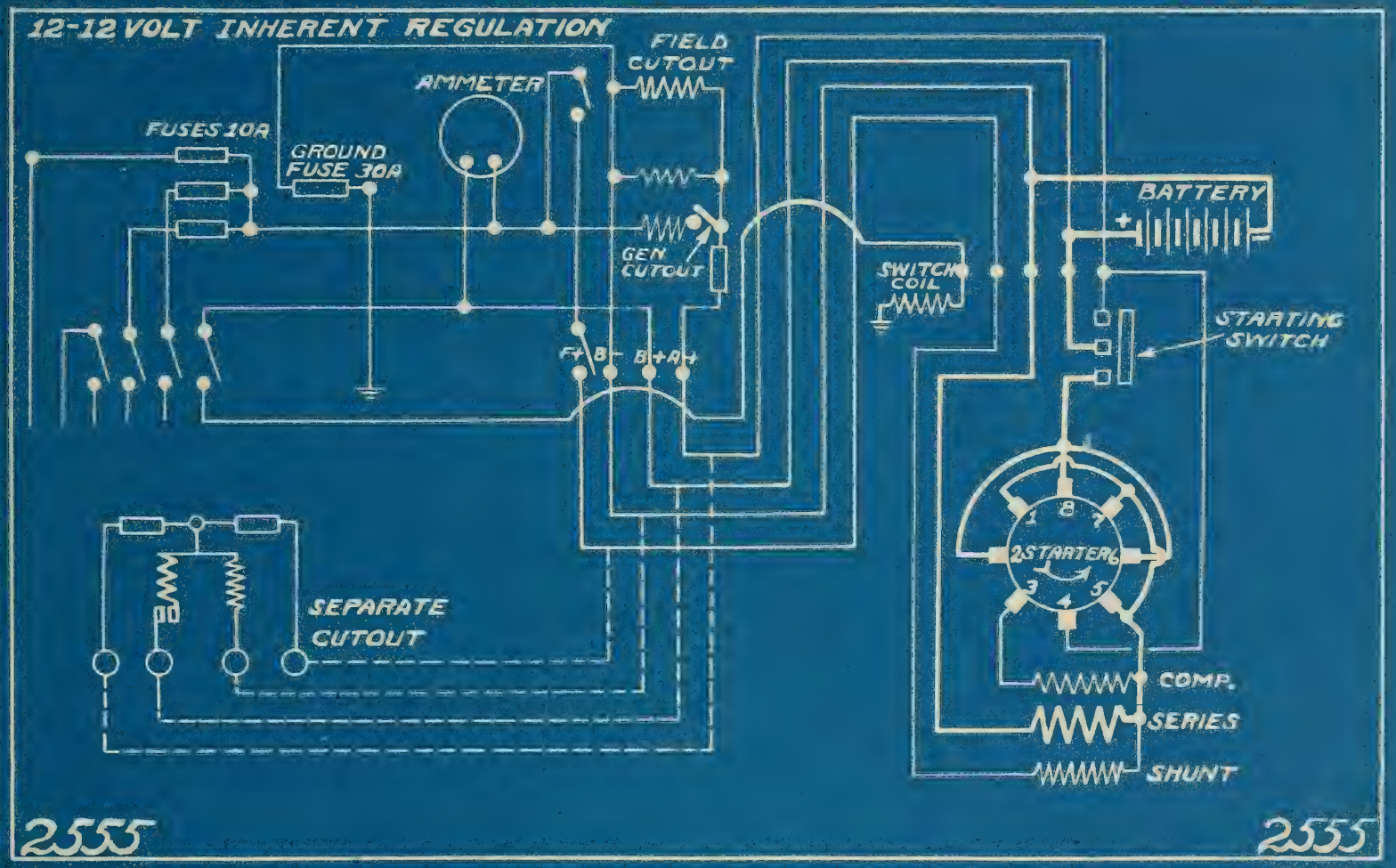
U.S.L. INTERNAL CIRCUITS



U.S.L. INTERNAL CIRCUITS

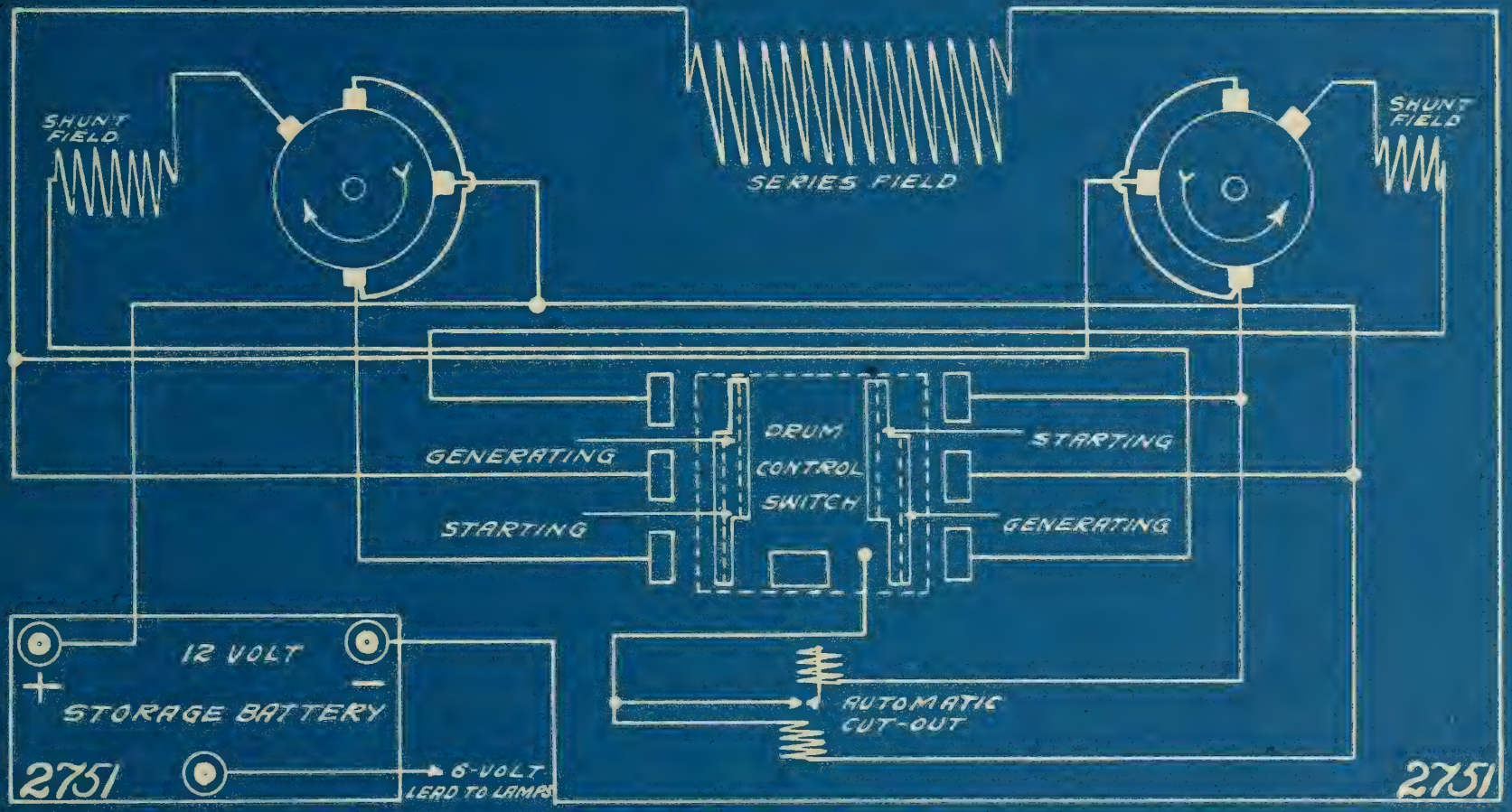


U.S.L. INTERNAL CIRCUITS



WAGNER INTERNAL CIRCUITS

12 VOLT SINGLE UNIT MOTOR-GENERATOR-EARLY MODELS



WAGNER INTERNAL CIRCUITS

GENERATOR
SPEC. 107-111

2753

GENERATOR
SPEC. 114

2754

MOTOR
SPEC. 106-110

2755

WAGNER INTERNAL CIRCUITS

GENERATOR

SPEC.
126 133-162
165-169-189
189A-200-202
214-276-277
303-305

2757

GENERATOR

SPEC. 155

2758

GENERATOR

SPEC. 278

2759

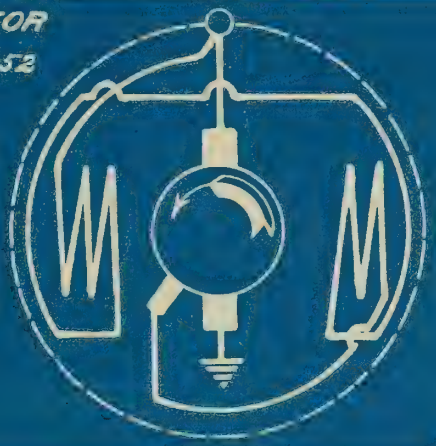
GENERATOR

SPEC. 337

2760

WAGNER INTERNAL CIRCUITS

GENERATOR
SPEC. 316-352

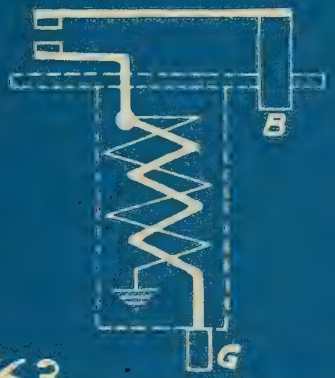


2761

GENERATOR
SPEC. 338-339-353

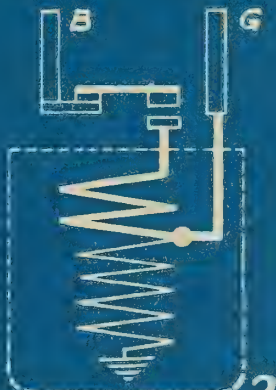
2762

CUTOUT



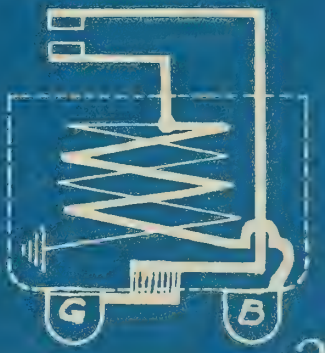
2763

CUTOUT



2764

CUTOUT

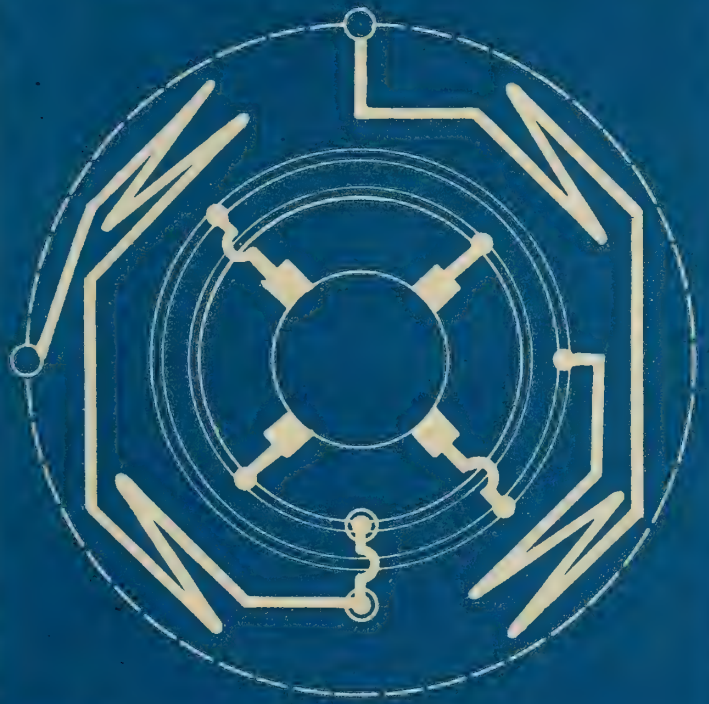


2765

WAGNER INTERNAL CIRCUITS

MOTOR

117-154-156-158-161-166-168-171-175
175A-180-183-201-266-272-291-298-320
362-368-375



2767

MOTOR

278-322-348

2768

WAGNER INTERNAL CIRCUITS

MOTORS

113

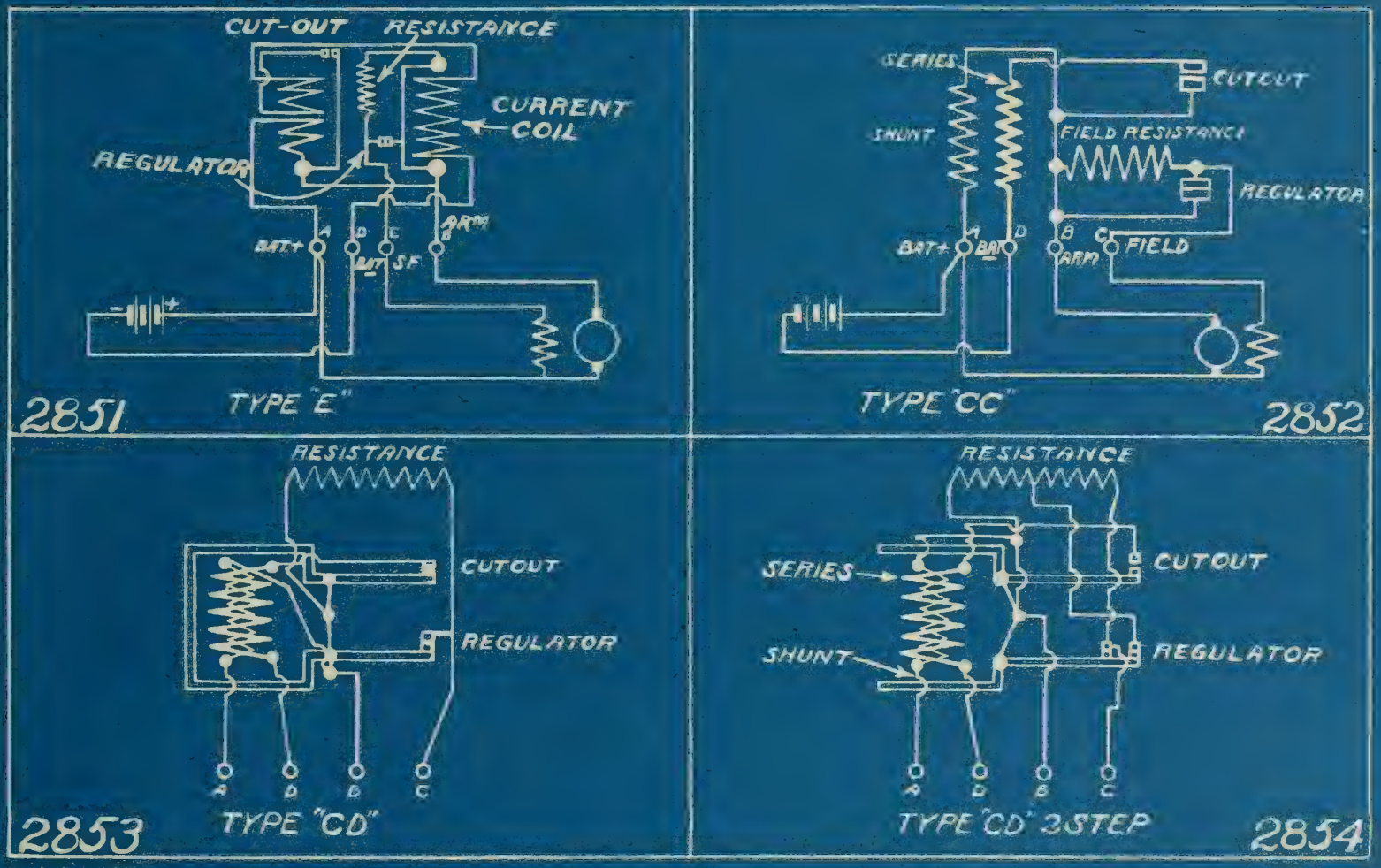
199-218

353-356-378-379-382

2769

2769

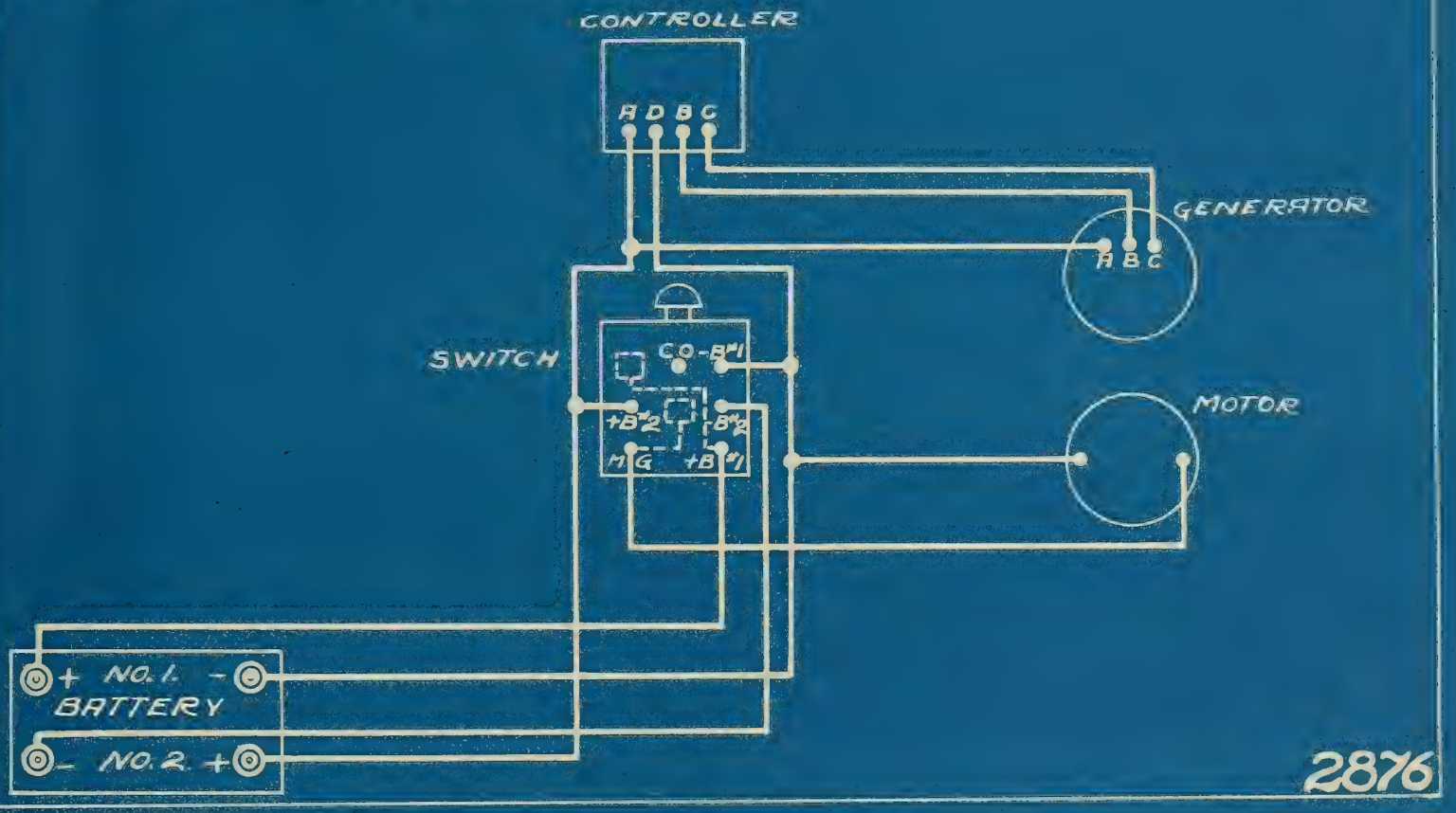
WARD LEONARD CONTROLLERS



WAGNER WARD LEONARD

STARTING SYSTEM TWO UNIT 6-12 VOLT.

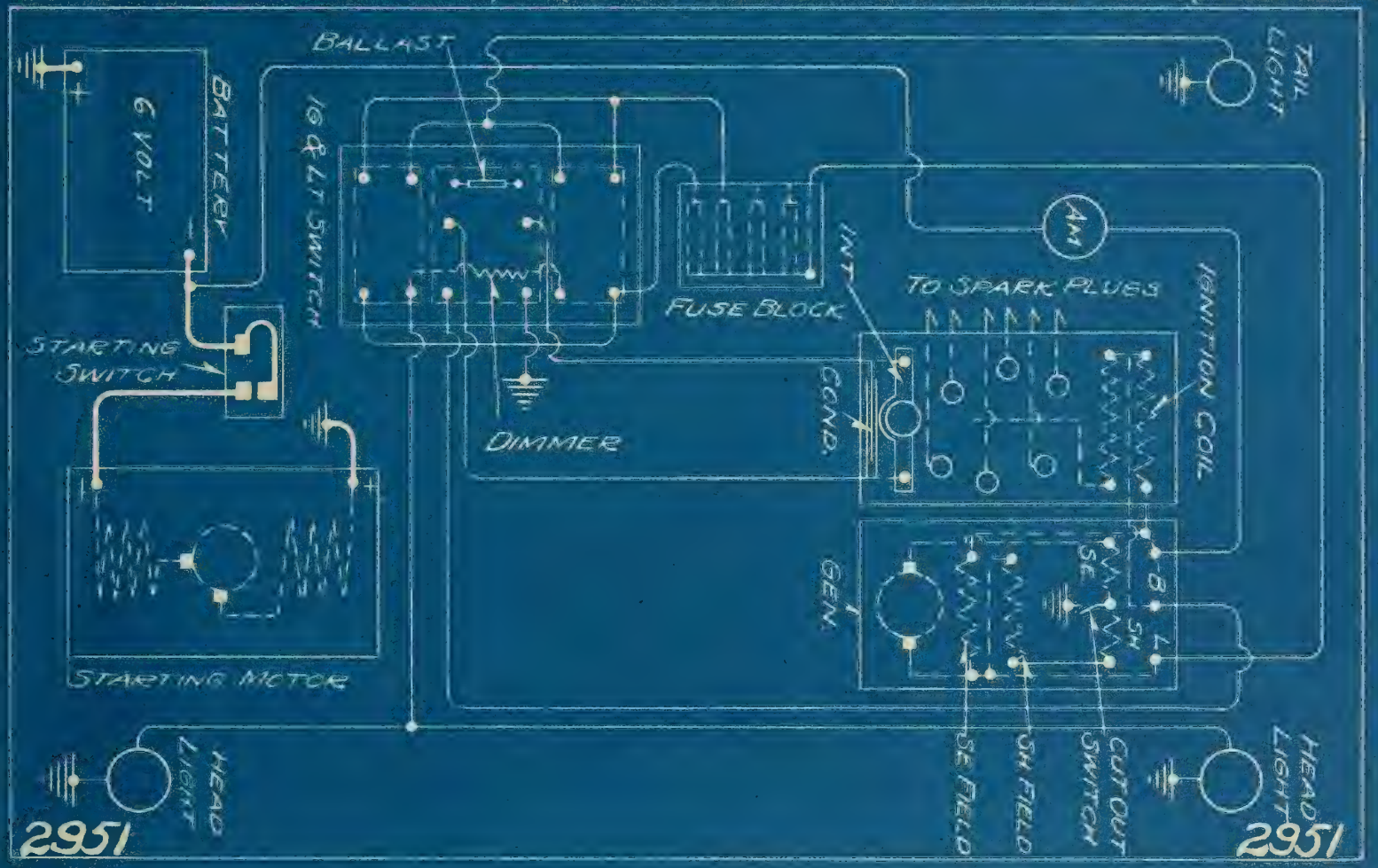
AS INSTALLED ON VARIOUS
MOTOR CARS AND TRUCKS
NOT ORIGINALLY EQUIPPED.



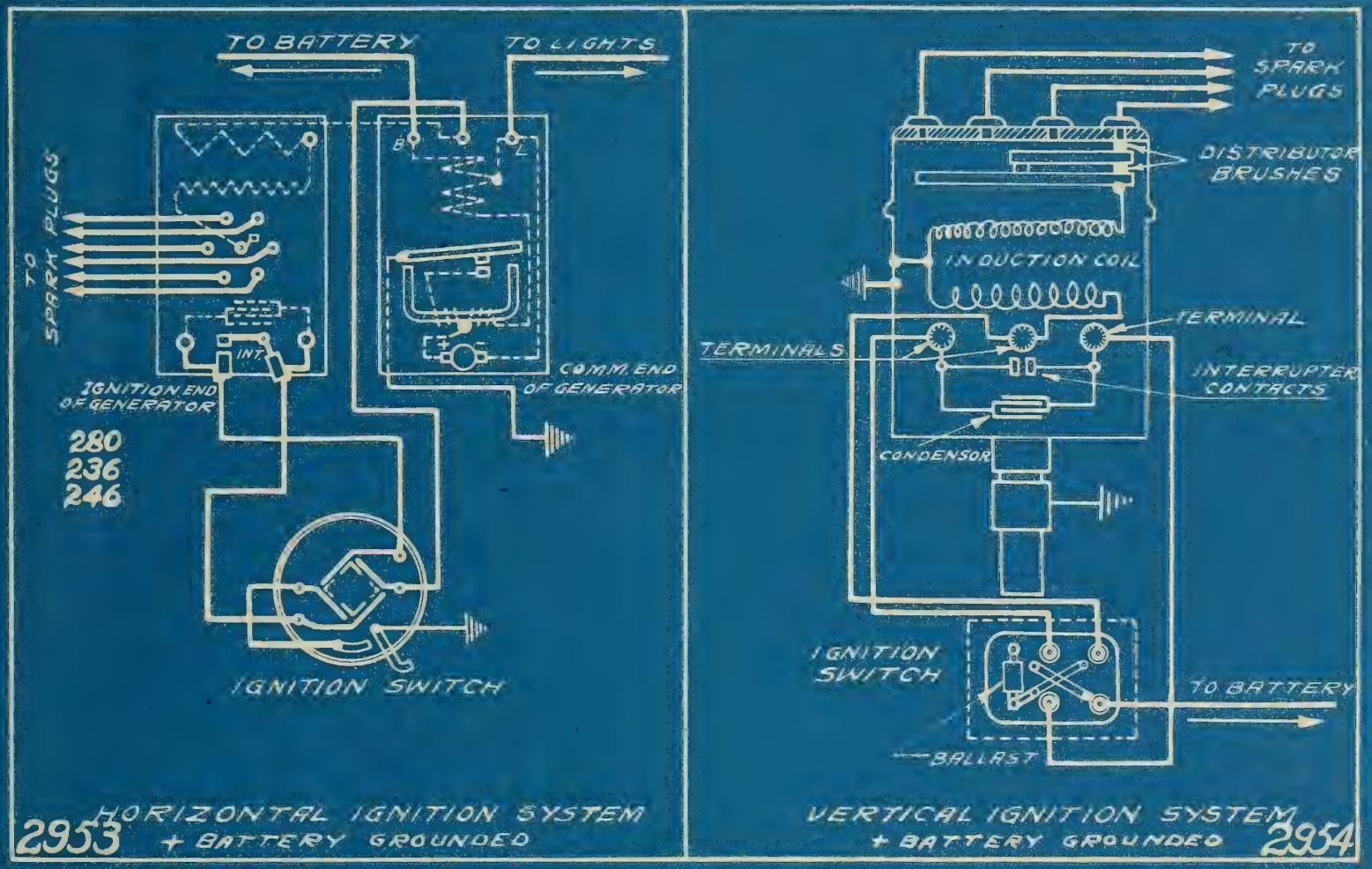
2876

WESTINGHOUSE INTERNAL CIRCUITS

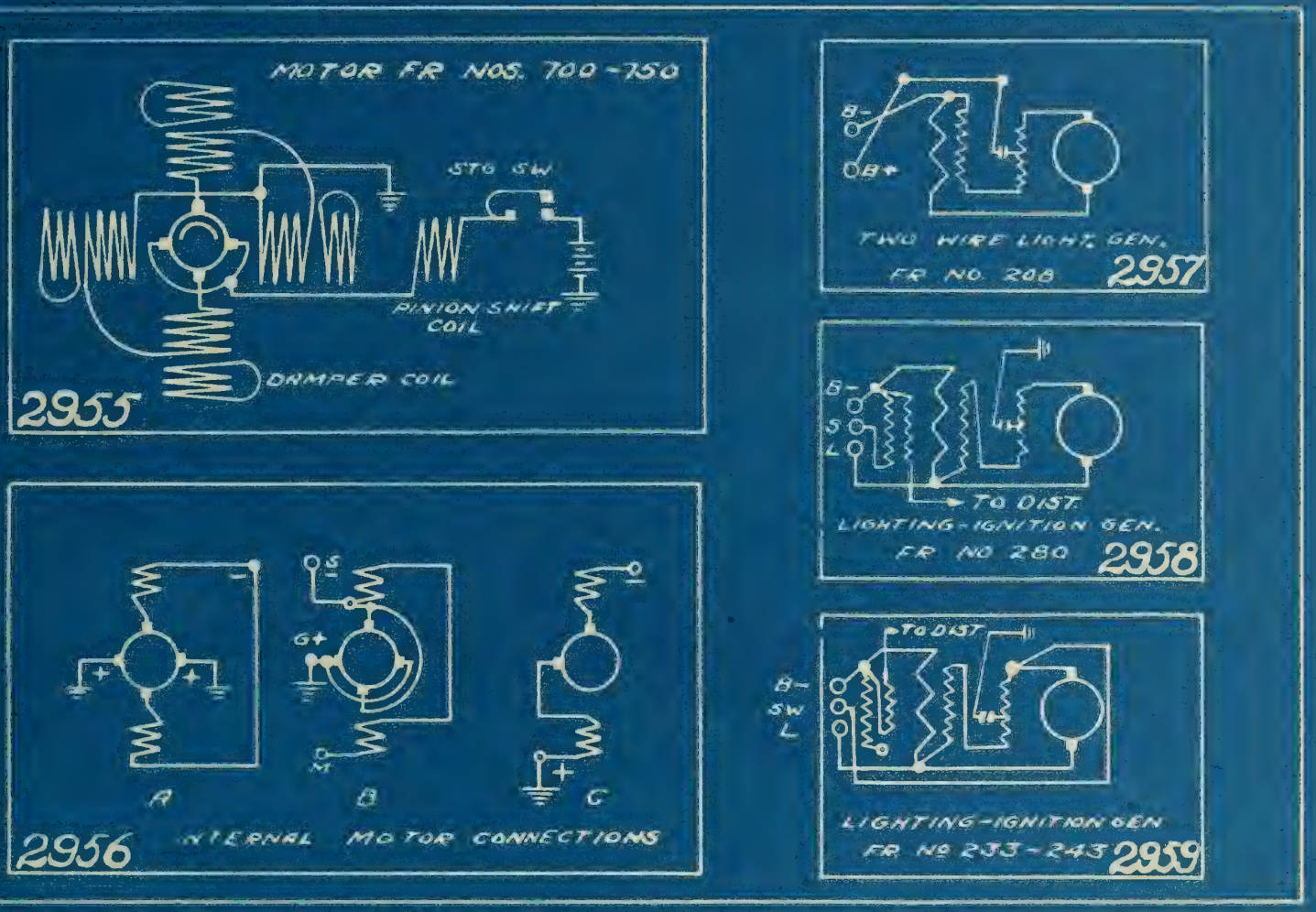
CONNECTION FOR STD MOTOR, LT & IG. GEN. 2 GANG LT. & IG. SWITCH AM - & FUSE BLOCK



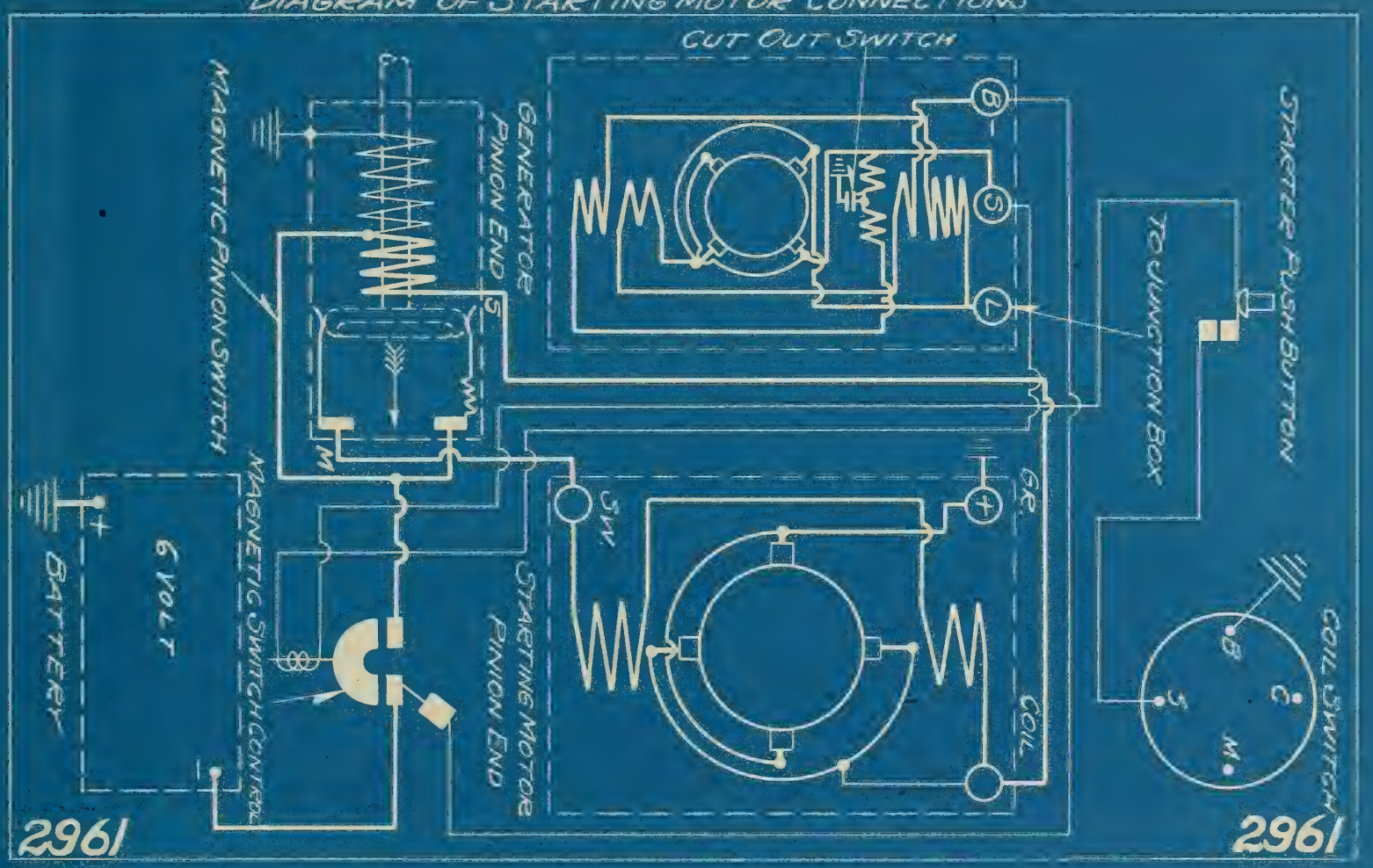
WESTINGHOUSE INTERNAL IGNITION CIRCUITS



WESTINGHOUSE INTERNAL CIRCUITS

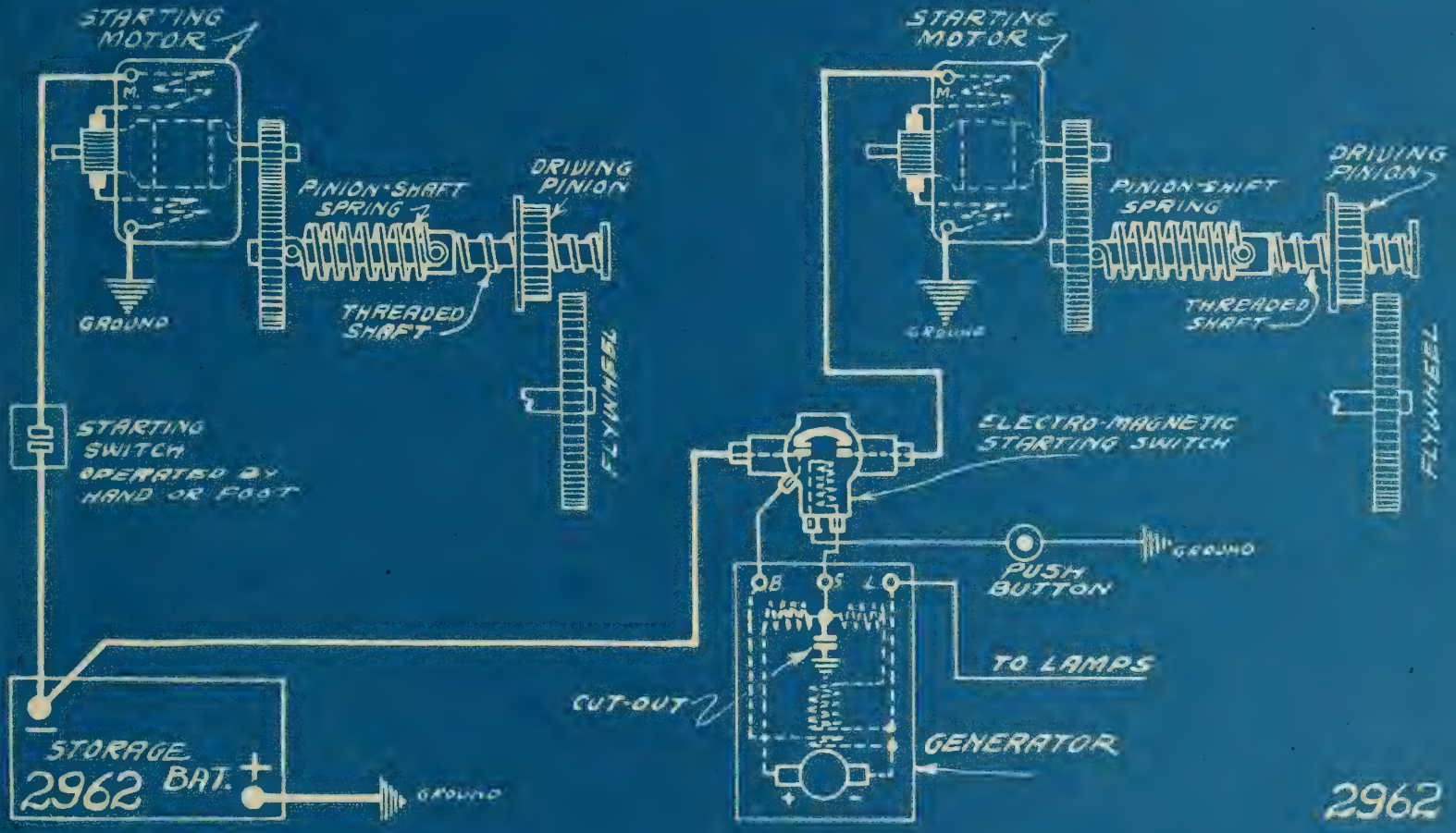


WESTINGHOUSE INTERNAL CIRCUITS



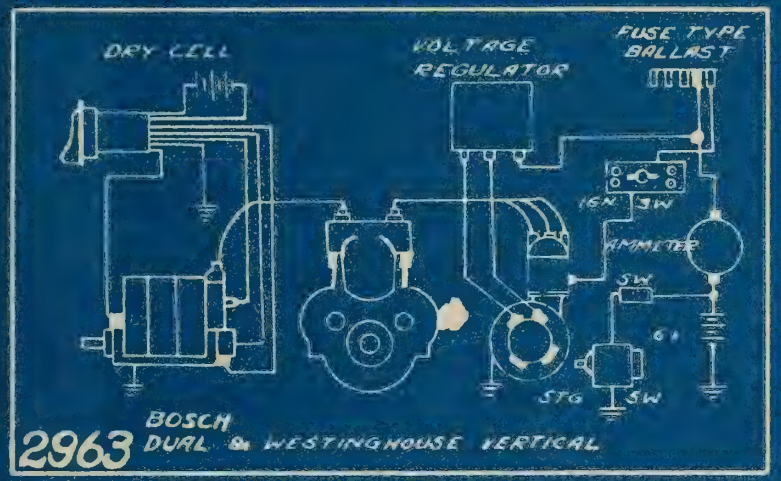
WESTINGHOUSE - INTERNAL WIRING AND MECHANICAL CONNECTIONS

OF DOUBLE-REDUCTION MOTORS AND SWITCH FOR AUTOMATIC SCREW PINION SHIFT.

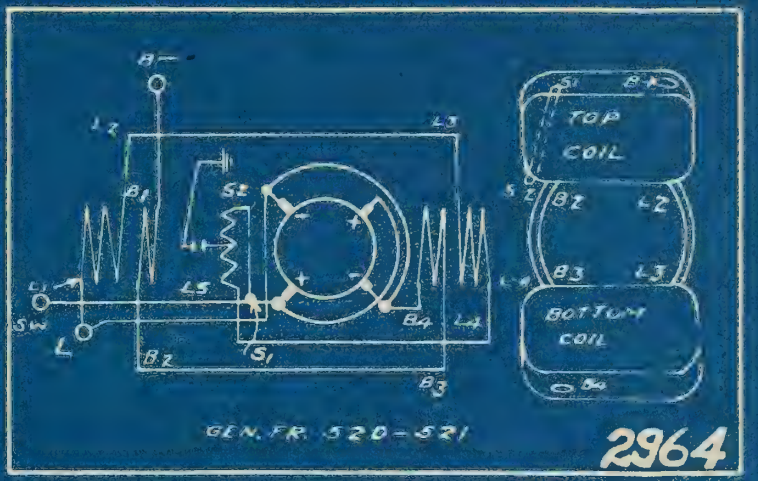


2962

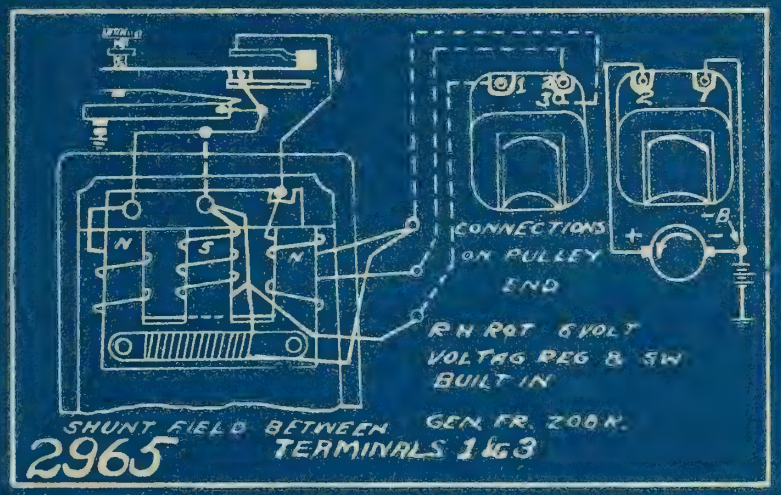
WESTINGHOUSE INTERNAL CIRCUITS



2963 BOSCH DUAL & WESTINGHOUSE VERTICAL



GEN. FR. 520-521 2964

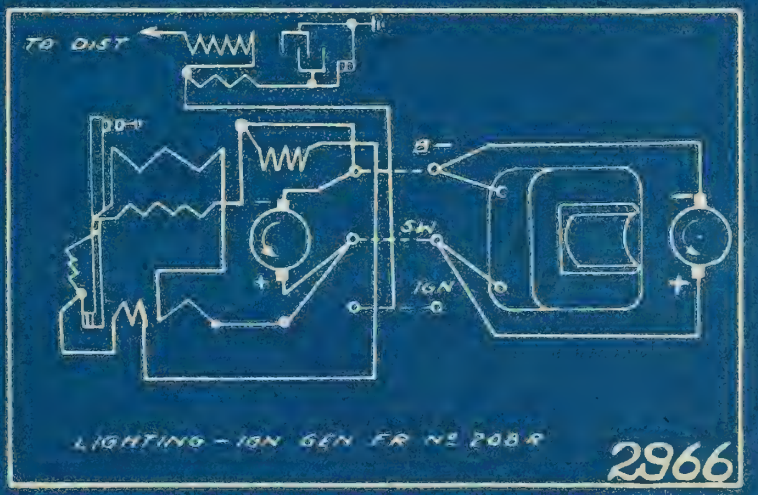


SHUNT FIELD BETWEEN TERMINALS 1 & 3

RN RAT 6 VOLT VOLTAG REG & SW BUILT IN

GEN FR. 2008N.

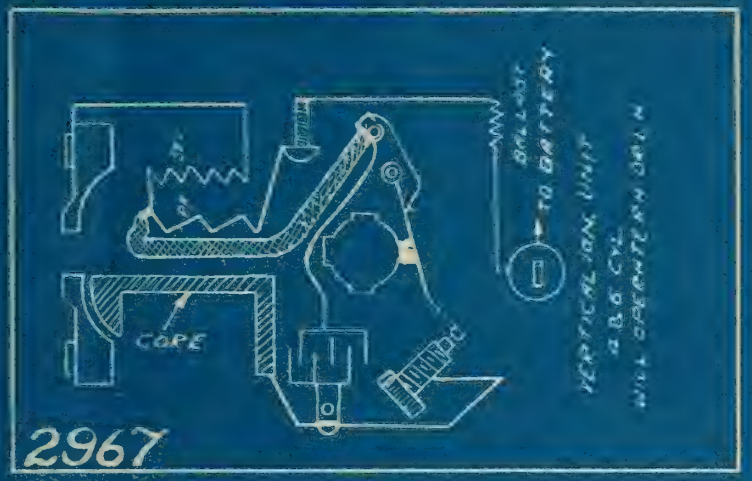
2965

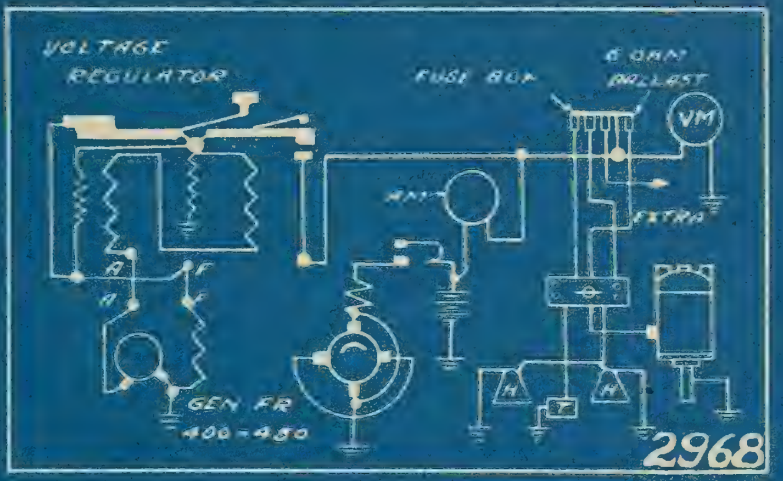


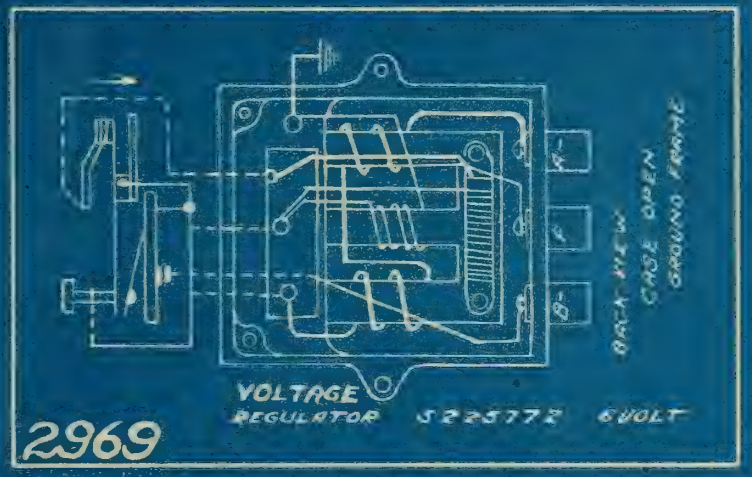
LIGHTING - IGN GEN FR Nº 208R

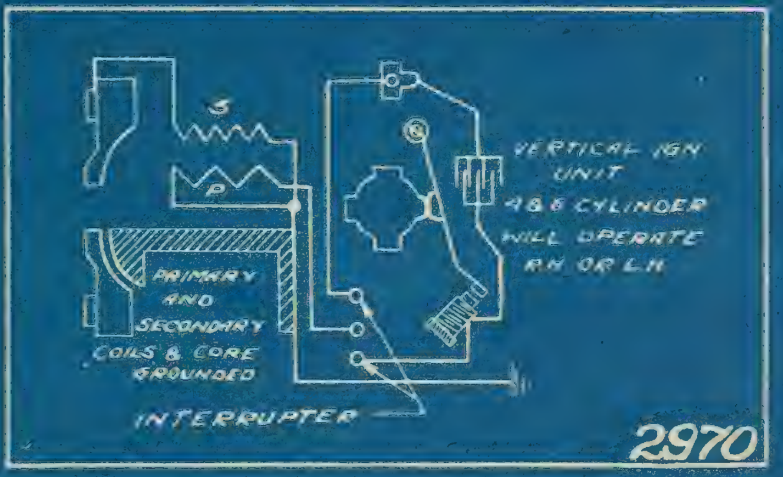
2966

WESTINGHOUSE INTERNAL CIRCUITS

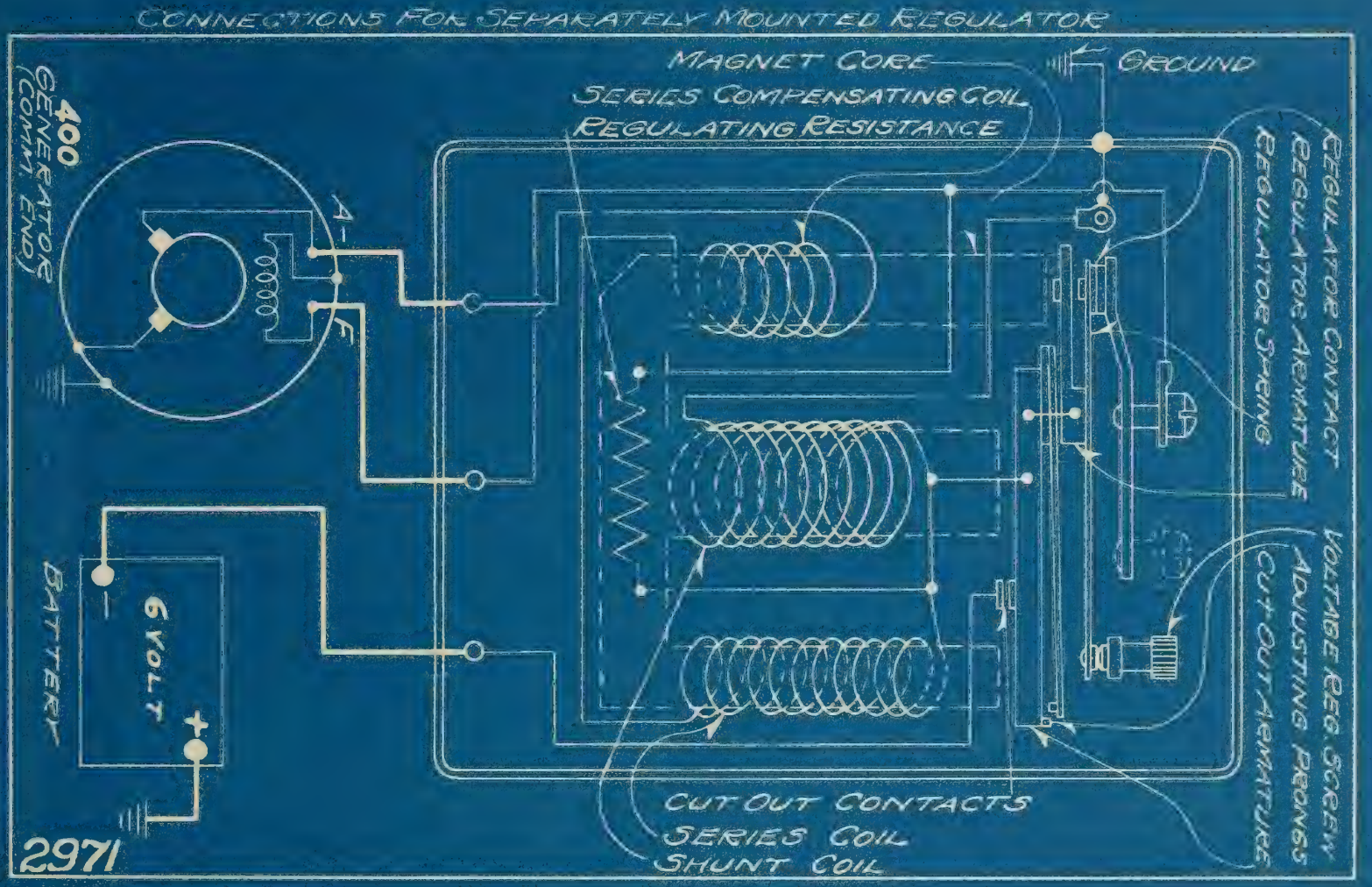






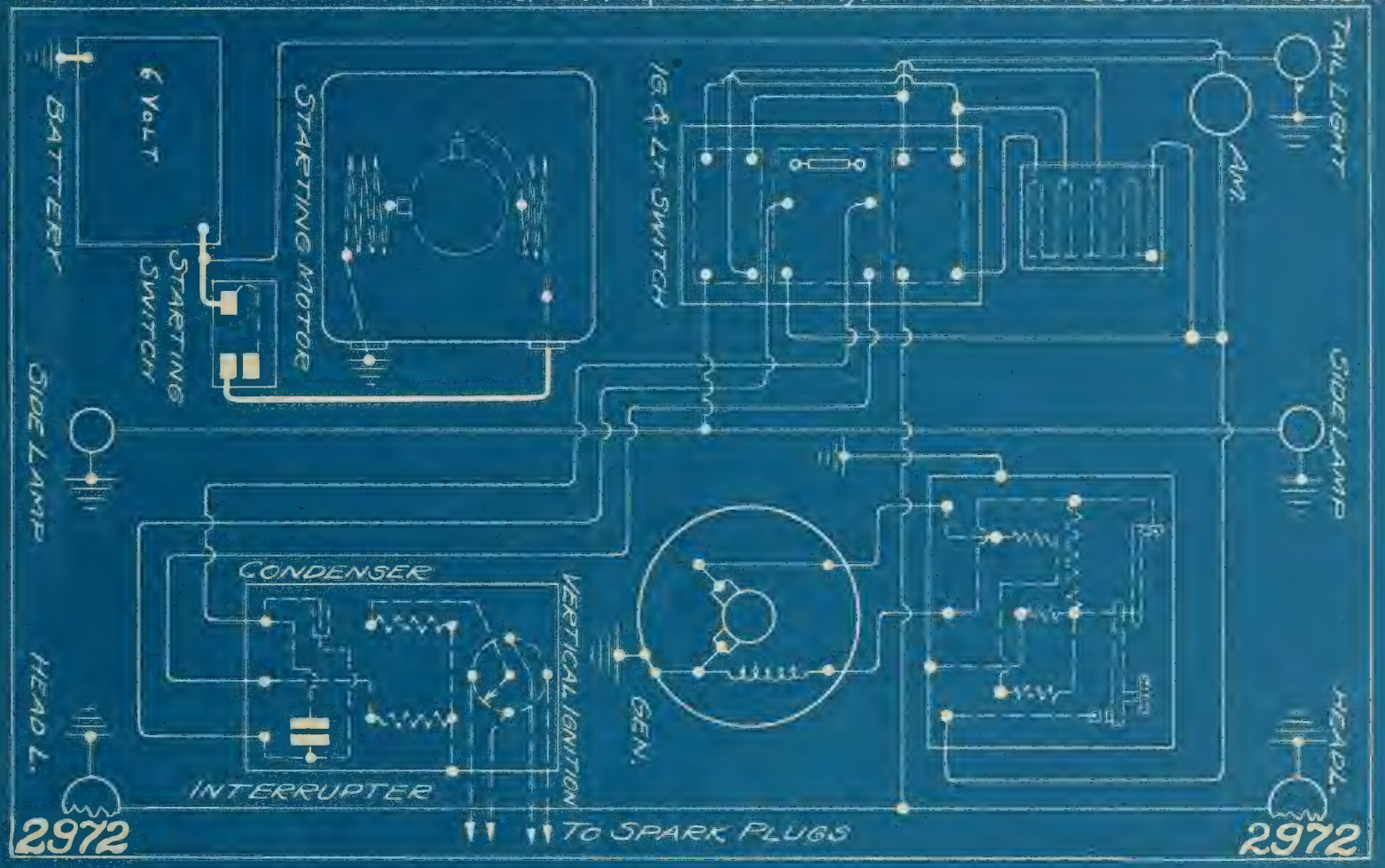


WESTINGHOUSE INTERNAL CIRCUITS

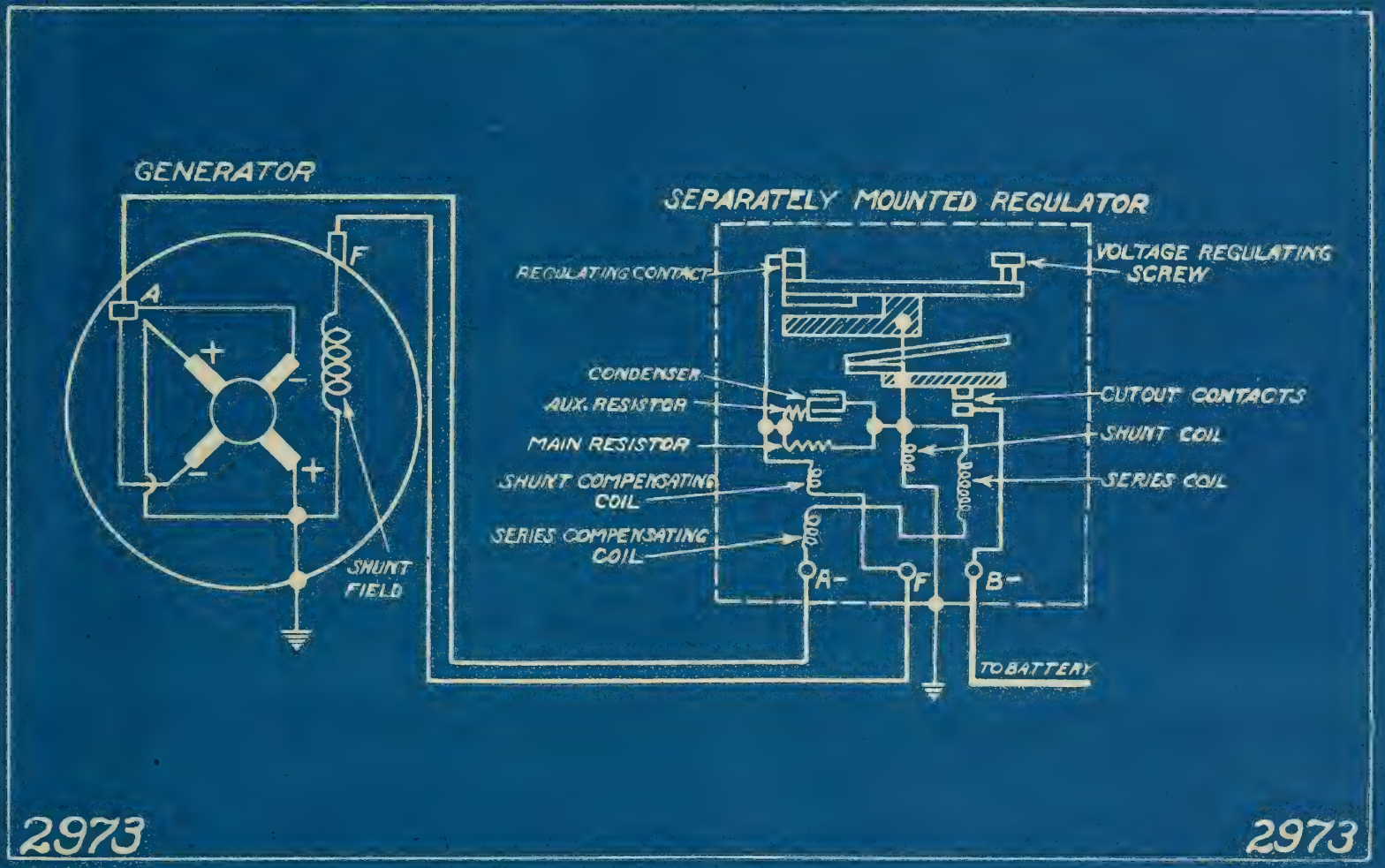


WESTINGHOUSE INTERNAL CIRCUITS

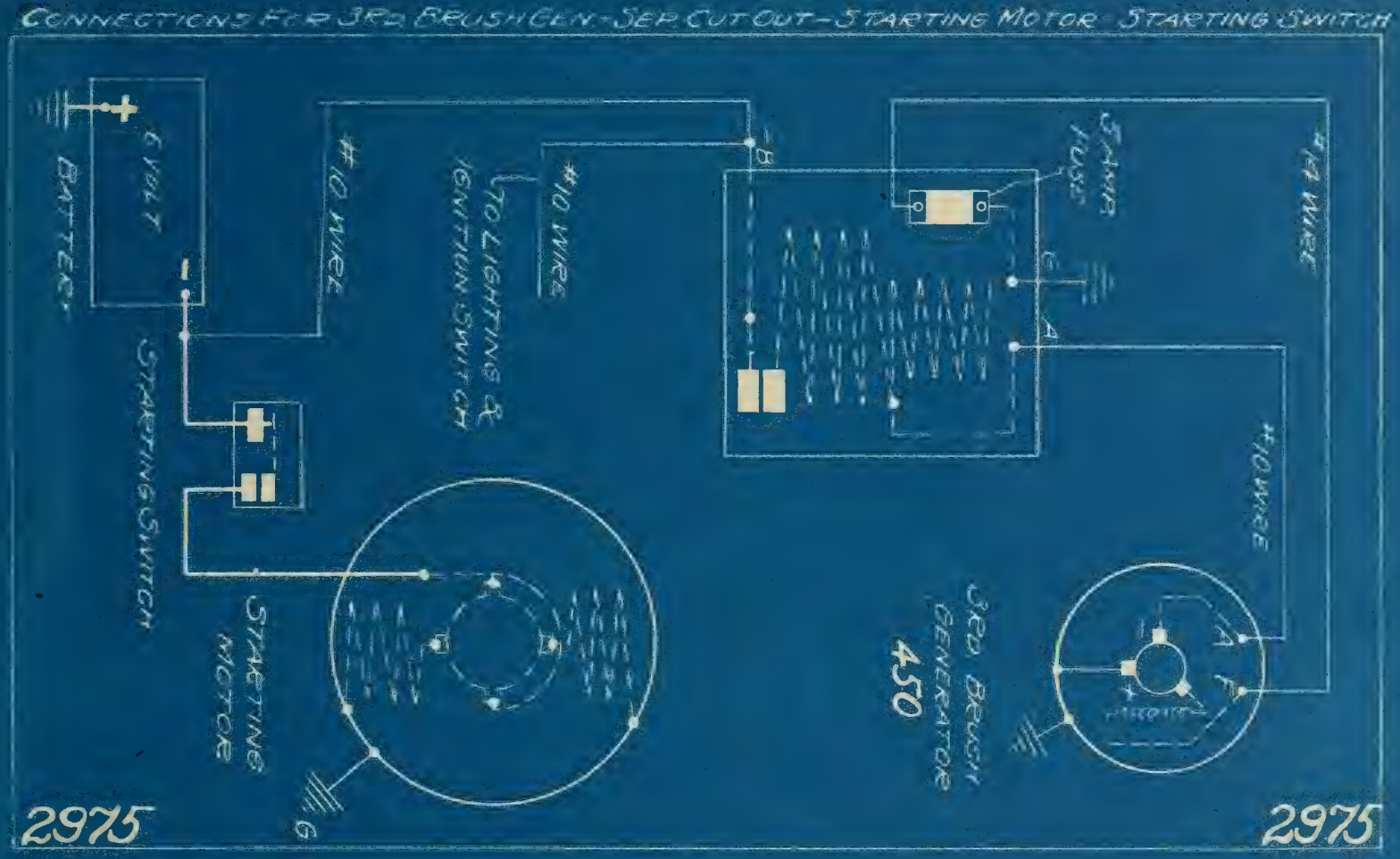
CONNECTION FOR RD. GEN. WITH SEP. REG. VERT. 16 (SGL. RED MOT.) AM. FUSE BLOCK. STD. SW. REVERS. LTG. SW.



WESTINGHOUSE 781R GENERATOR

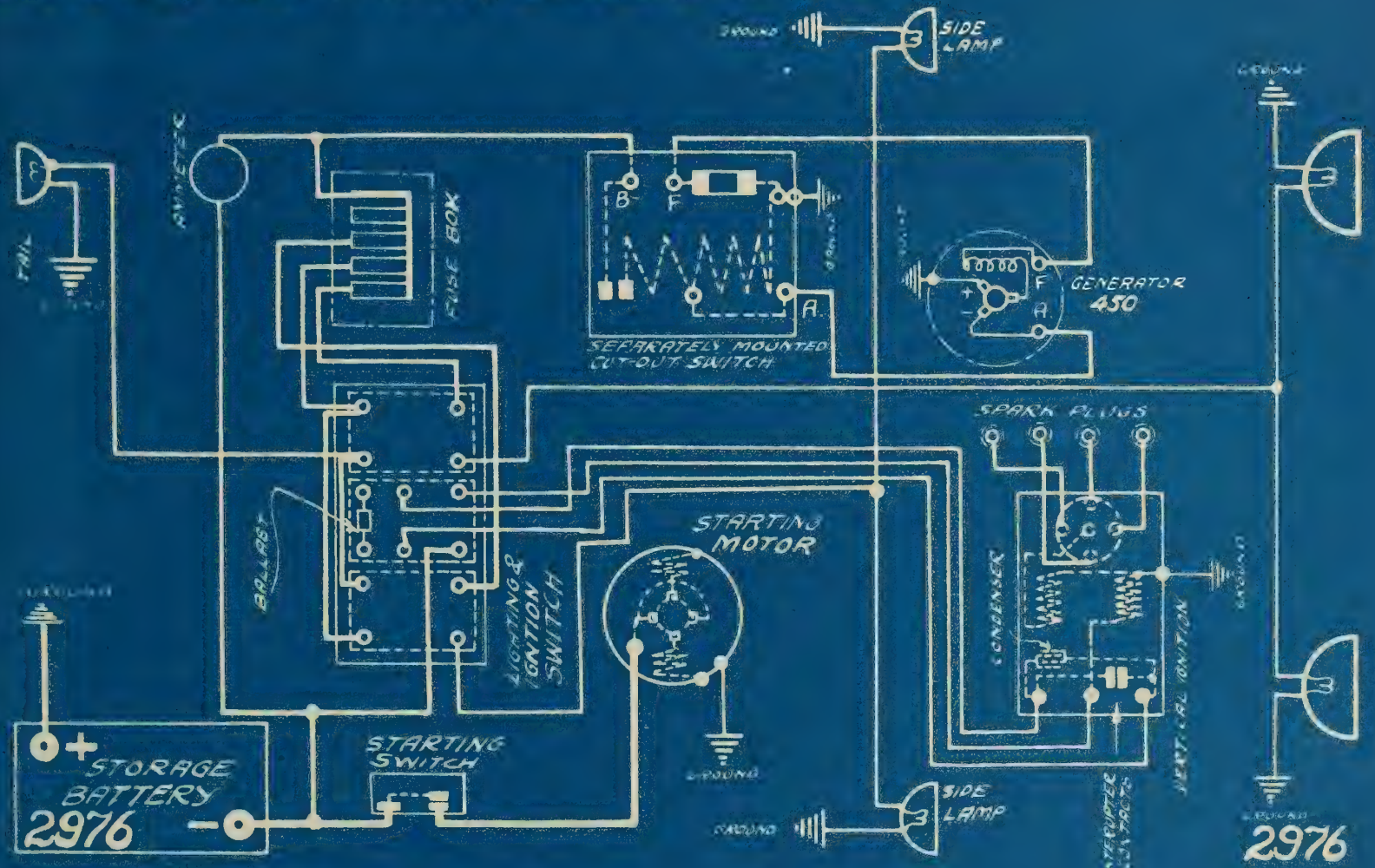


WESTINGHOUSE INTERNAL CIRCUITS



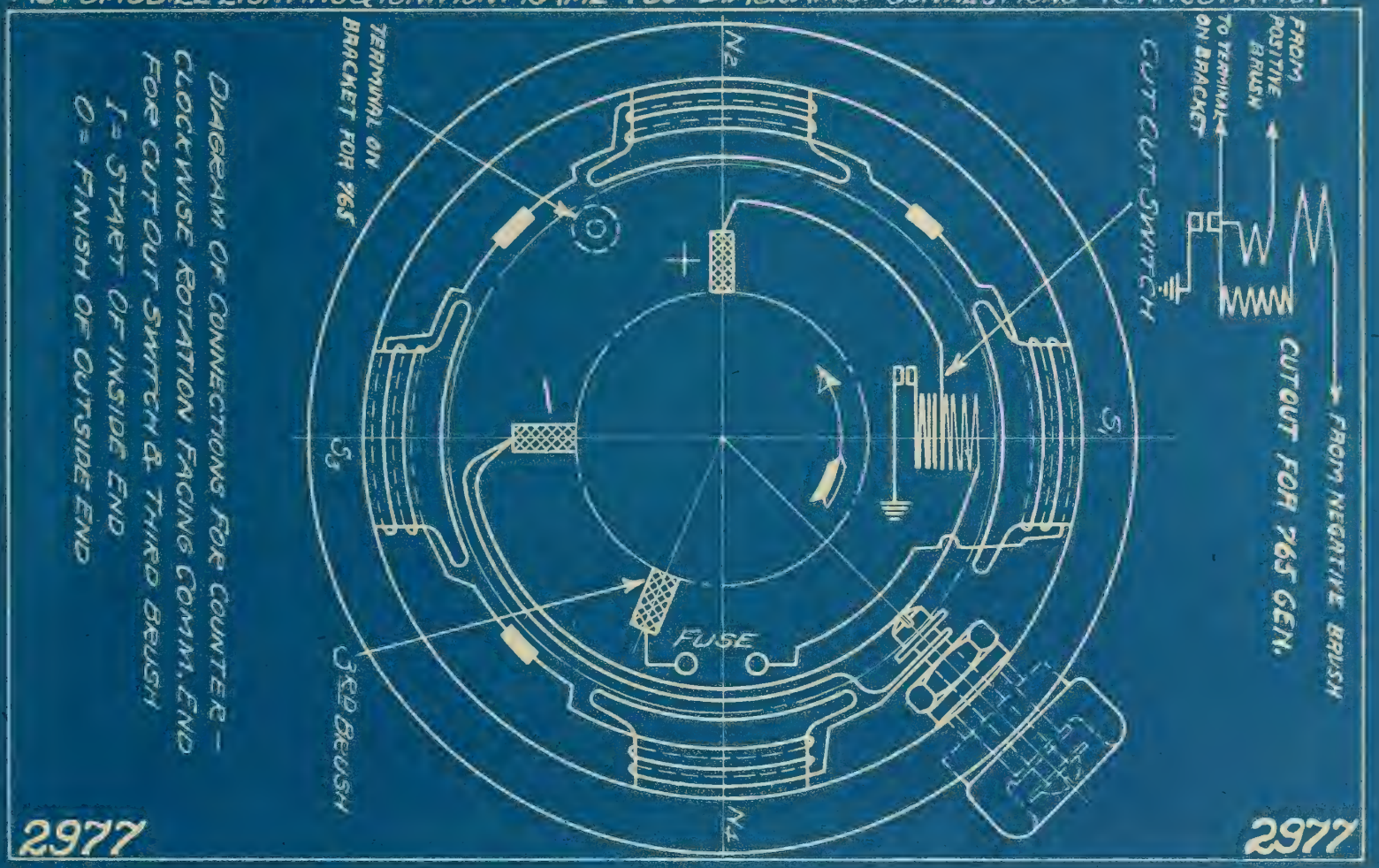
WESTINGHOUSE STANDARD WIRING

SHOWING SINGLE REDUCTION MOTOR & VERTICAL IGNITION SYSTEM.



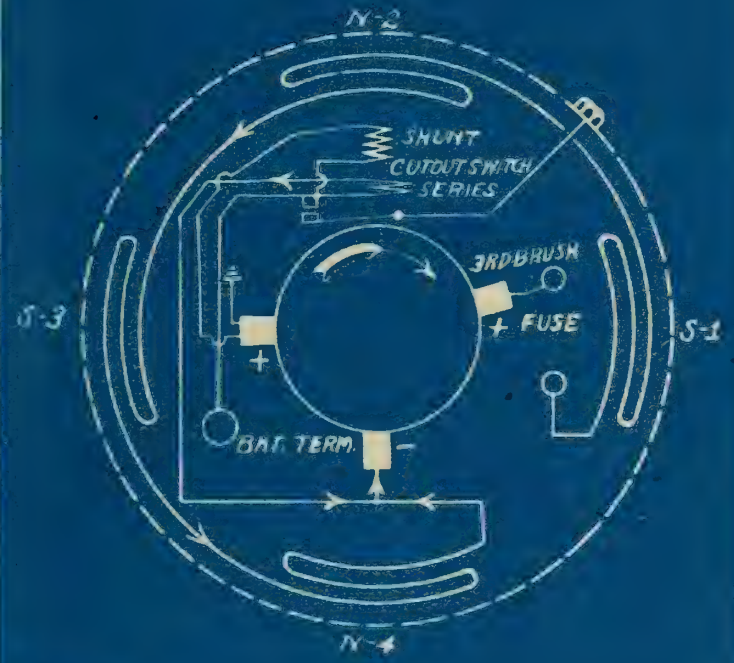
WESTINGHOUSE INTERNAL CIRCUITS

AUTOMOBILE LIGHTING & IGNITION FRAME *760 - DIAGRAM OF CONNECTIONS - R.H. ROTATION



WESTINGHOUSE INTERNAL CIRCUITS

GENERATOR
760 INTERNAL CUTOUT
THIRD BRUSH ON RIGHT



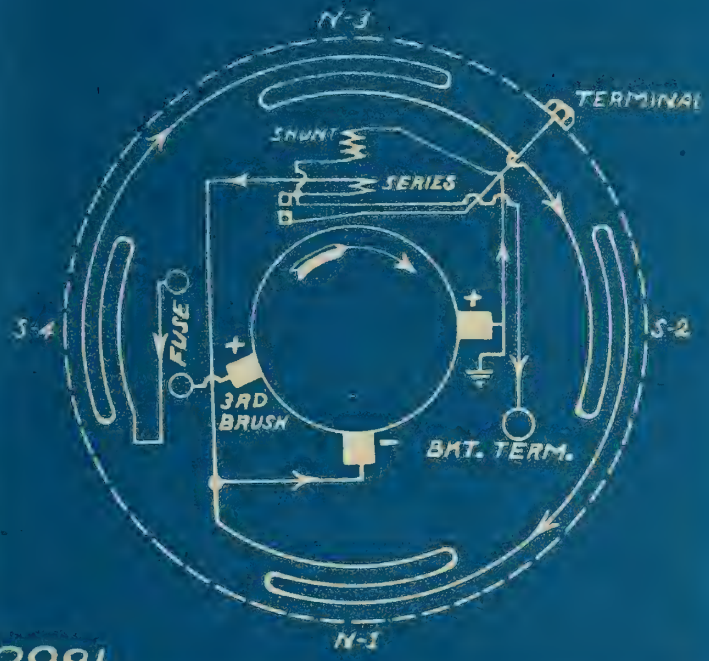
2979

GENERATOR
760 & 765 FOR EXTERNAL CUTOUT

2980

WESTINGHOUSE INTERNAL CIRCUITS

GENERATOR
760 INSULATED INTERNAL CUT-OUT
TERMINAL ON BRACKET



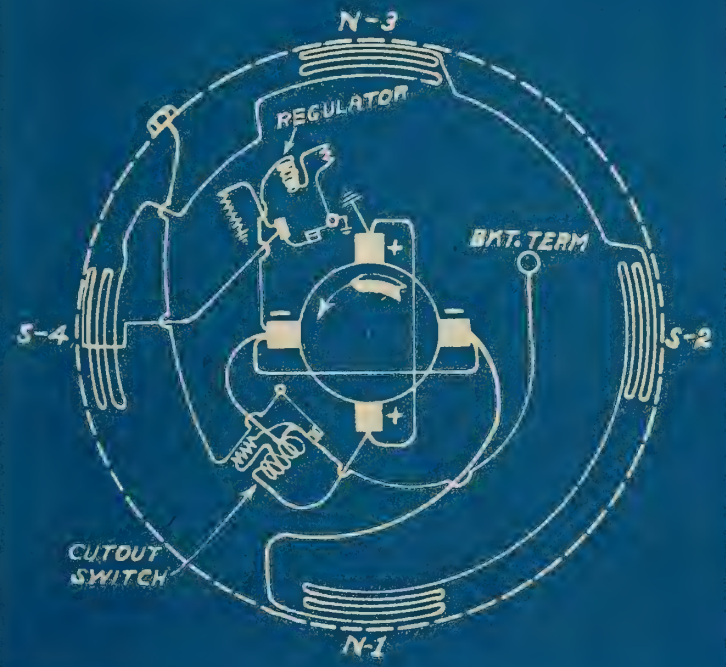
2981

GENERATOR
760 THIRD BRUSH ON LEFT
INTERNAL CUT-OUT

2982

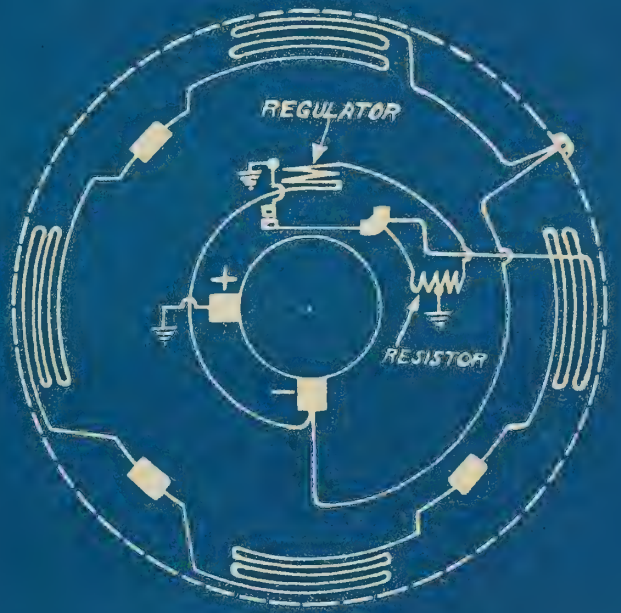
WESTINGHOUSE INTERNAL CIRCUITS

761R-762R & 780R
CAM REGULATED GENERATOR
INTERNAL CUTOUT



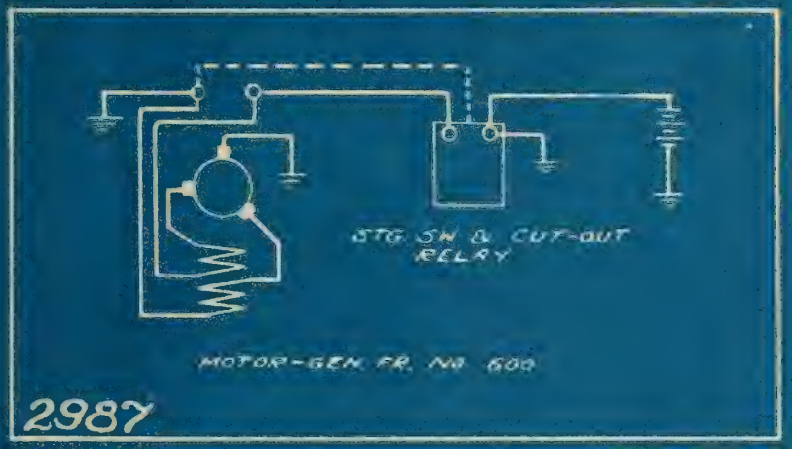
2983

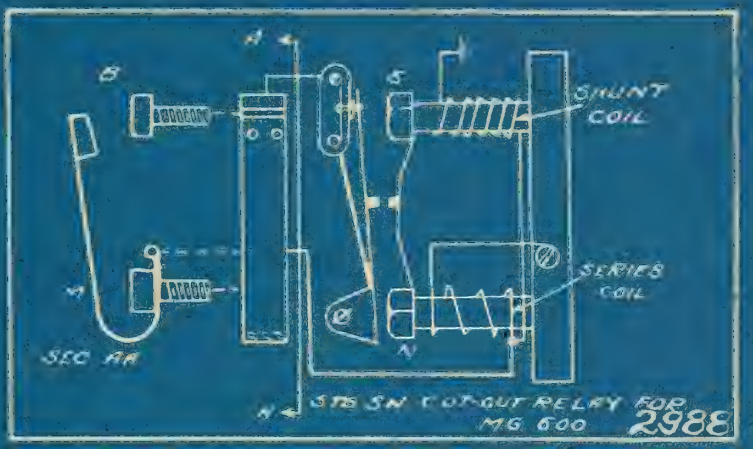
150R-151R & 760R
CAM REGULATED GENERATOR
EXTERNAL CUTOUT

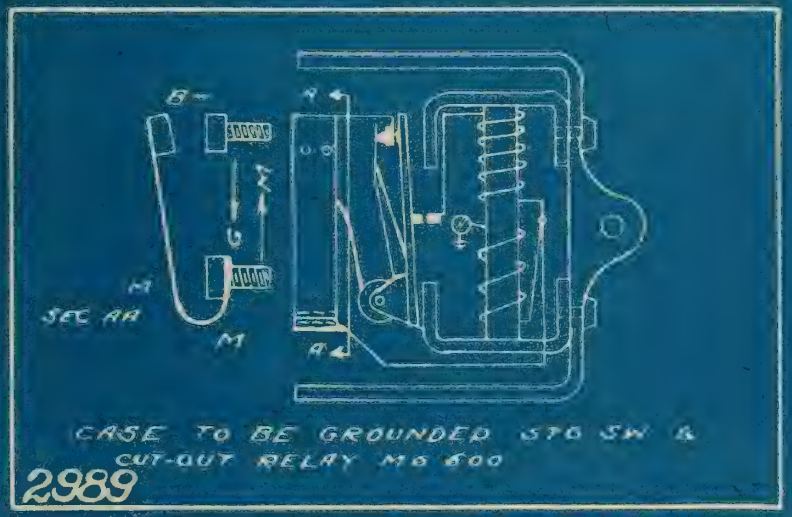


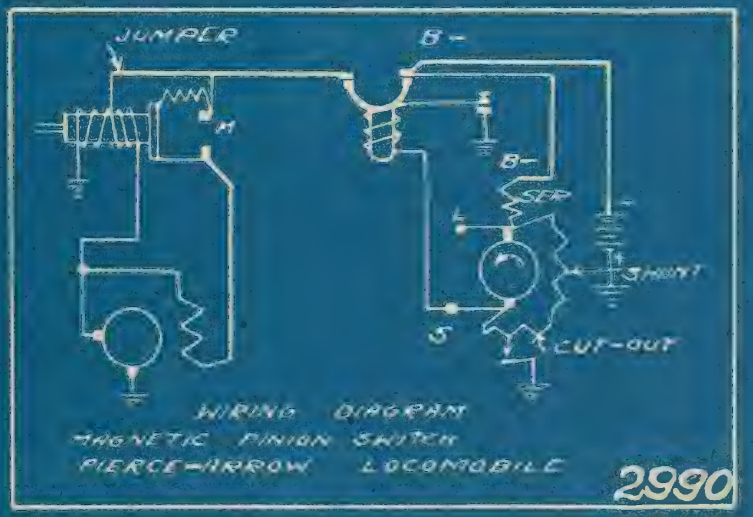
2984

WESTINGHOUSE INTERNAL CIRCUITS









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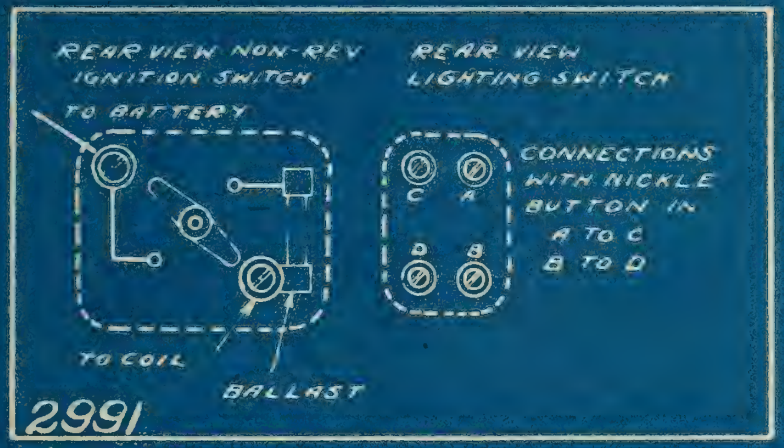

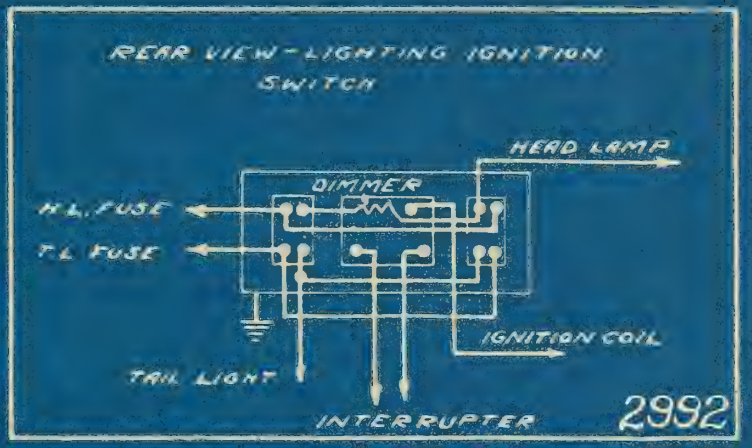

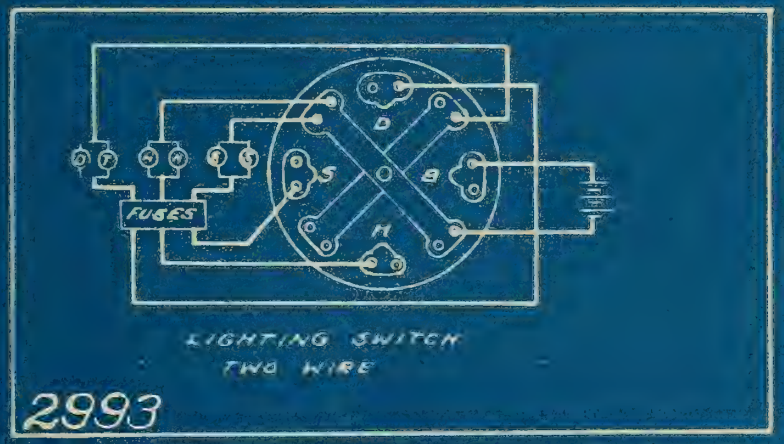

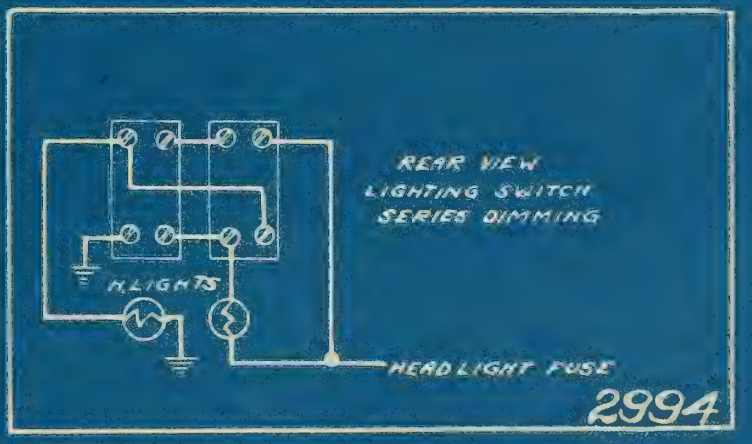

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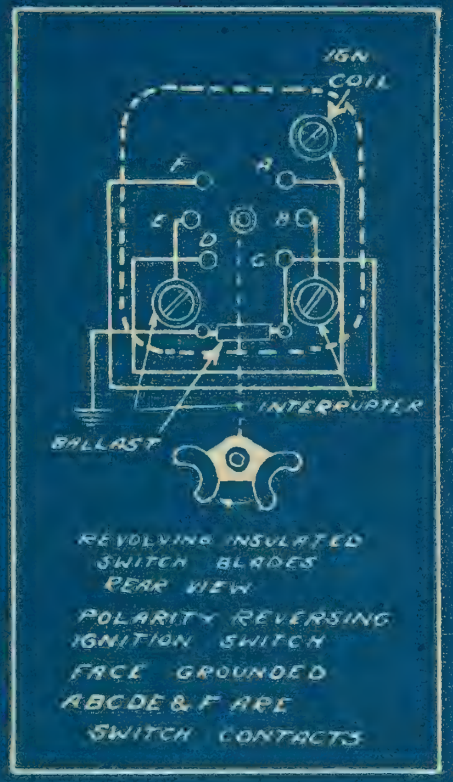

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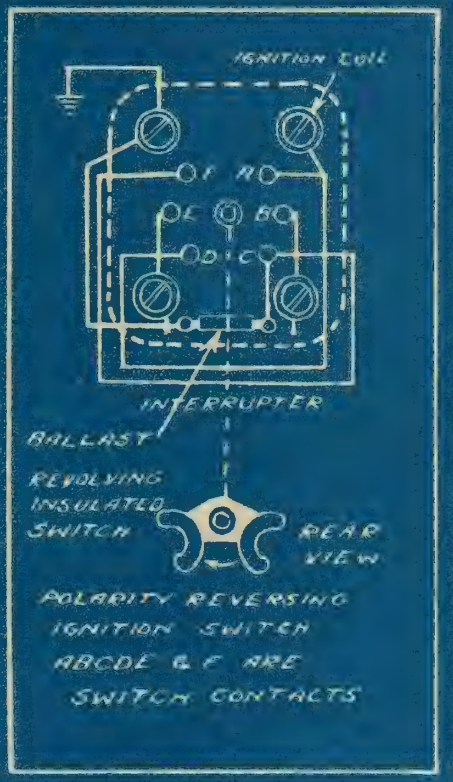

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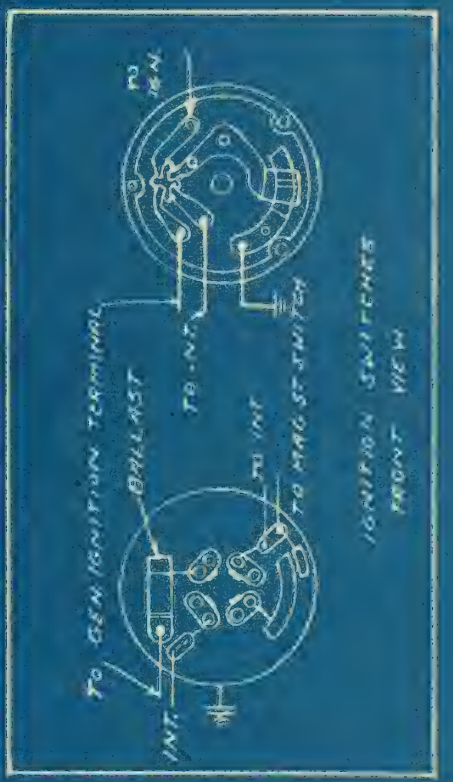

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